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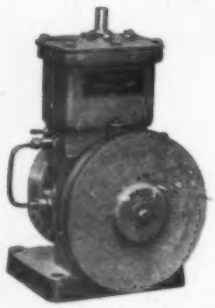

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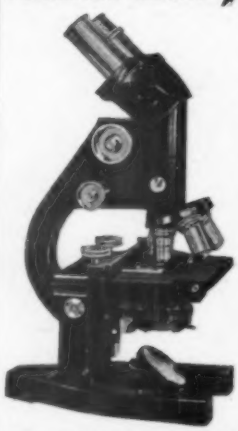

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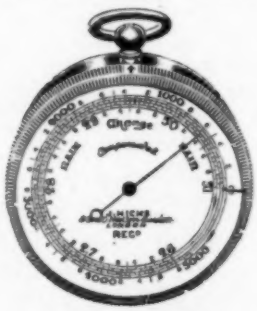

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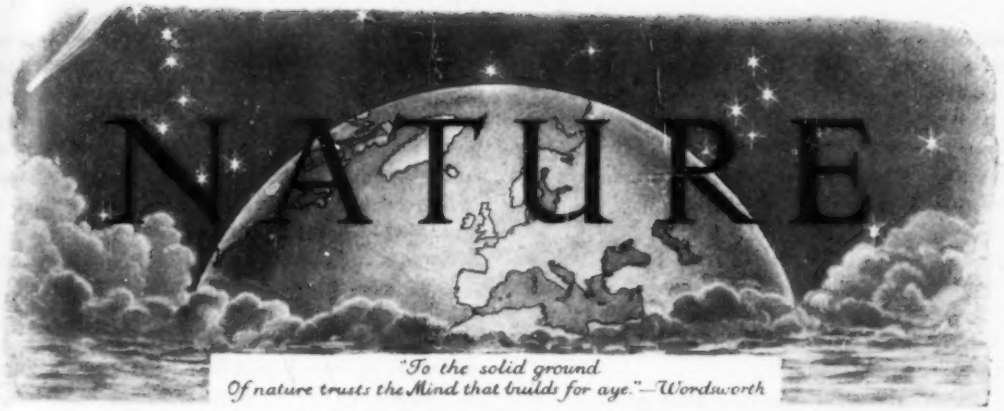


Vol. 147 SATURDAY, JANUARY 4, 1941 No. 3714

COLLABORATION IN EUROPE

FROM time to time in the past few months, reference has been made in these columns to the need for consideration of the reconstruction which will have to be faced after the War. The King, in his Christmas Day broadcast, referred to the new unity which comes from common perils and common suffering endured, and pointed out that we must hold fast to this spirit of unity in the days to come, both in our own lives and even more among the nations. The Archbishop of Canterbury has stressed the urgency of reconstruction problems. Let there be no mistake. If they are given the time, the Nazis can and will build a new order in Europe embracing not only France but also those other countries on which their tyranny has in succession descended. That will not be an order for free men, and its basis, as Mr. Bevin pointed out in a recent vigorous address, will be the racial superiority of the Germans.

The two outstanding characteristics of the War are indeed, first, that it is in substance a civil war, and secondly, that the conditions which led to its outbreak will not be cured or reformed merely by victory and the rehabilitation of pre-War Europe. To the first the presence, legalized by the Allied Forces Act, in Great Britain of six foreign armies, training under their own flags, their own commanders, their own military law, testifies. We must also count among the freemen of Europe the Germans, Austrians, Italians and Spaniards who are still eager to serve as pioneers and sappers for the intellectual engineering jobs of the War and post-War, as well as the many refugees now being mobilized for technical service through the International Labour Branch of the Ministry of Labour.

From this derives our right and responsibility in opposing the Nazi regime to call upon the love of liberty and respect for human rights all over the world and make ourselves their champion. This involves, as Mr. Bevin so clearly insisted, the readiness to face great changes in our own society. Further, our present propaganda seems to be handicapped by lack of understanding of democracy in Europe, and until we show ourselves in the War and in our plans for the future more of a democratic nation, we shall not fire the imagination of Europe or of our own society in a way that is commensurate with the leadership devolving upon us.

Consciousness of this is clearly betrayed in Mr. Bevin's recent speeches, and lies at the basis of the demands being voiced for an official statement of our own war aims. A statement of the basic principles which we intend to see embodied in the new world order is an important contribution to that end, and an assurance that a Cabinet committee is working unremittingly on a design for twentieth-century living, in the sphere of international affairs as in that of reconstruction at home, might reasonably be asked.

Some token or expression of the forward-looking mind and an indication that the research and investigations and fundamental thinking about the problems really involved are the first essentials towards developing relations with the submerged democratic movements abroad, is the theme ably

argued by Mr. Francis Williams in his "War by Revolution"[1]. Mr. Williams argues that we can achieve our main object in the War by adopting the strategy of revolution. We must disrupt the Nazi system from within by appealing to the vast numbers of men and women, both in the occupied countries and in Germany itself, who are on the side of democracy against authoritarianism. This involves re-stating the democratic faith as a revolutionary faith, and taking the offensive everywhere, using those elements of the population in every country in Europe who are on the side of a new and true democracy.

This is also the theme of a series of world order papers recently published by the Royal Institute of International Affairs[2]; but the outstanding impression left by these papers is the distance we have yet to travel and the amount of work, both educational and research, which must be carried out before we can look for the establishment of a new order. There can be no international reconstruction, no establishment of a new world order, unless, as Sir John Fischer Williams argues in his outline of the minimum requirements of an effective federation which may be possible at the end of the present War, the minds and wills of those who command the obedience and embody the desires of humanity are set with friendly purpose to the achievement of the task. For all their lucidity and moderation, neither Sir John Fischer Williams nor Sir William Beveridge in his paper on peace by federation, are really any more convincing in their exposition of federation than Mr. R. G. MacKay's excellent "Federal Europe". For this there are two causes. First, the advocates of federalism have as yet scarcely dealt in any adequate measure with its practical difficulties. This can indeed be due in part to the tentative approach to the problem characterizing the soundest and ablest of its advocates. It may be due much more to the difficulty of finding an adequate basis in common interests, traditions, habits of thought, language, geographical continuity or the like, without which, as Prof. Gilbert Murray points out, a federation can scarcely maintain itself at all.

It follows from this that, should obstacles make actual federation at the end of the War unattainable, other steps must be taken for preserving the general peace. Sir William Beveridge, in discussing an approach to the German people, to be used possibly in such ways as Mr. Williams indicates, suggests indeed that we should state frankly our willingness to consider alternative proposals from the other side for the elimination of war, and he lays stress on the need for eliminating all sense of injustice and for handling the colonial and economic problems of the world on lines designed to that end as well as to the improvement of the standard of living. A first step towards the latter would be an International Reconstruction Commission, coming into action on the day that fighting stops, and charged with the duties of relieving distress, repairing war damages, and re-establishing prosperity for all at the common charge of all. One characteristic of these papers is, indeed, the consensus of opinion as to the importance of building on what foundations already exist and have proved their value.

The second point on which the consensus of opinion is remarkable is the necessity of some positive attempt to diminish the economic causes of war. Mr. P. Horsfall, in a paper entitled "Doubts as to the Imminence of the Millenium", remarks that it is neither a futile nor a mean ideal to work for this end through the co-operation of sovereign communities, without endeavouring to merge their distinctive national loyalties in a forced allegiance to a new State. The institutions and aims of any new association of nations must have regard not only to the hopes but also to the experience of mankind. Prof. L. Robbins's paper is indeed devoted to the economic factors tending to make for international diversity, and he shows that the great danger is not planning in general but independent planning by independent States. While he looks on the idea of complete and immediate federalization of all Europe immediately after an armistice as based on a delusion, he urges that out of the close associations of the present conflict there may come some permanent nucleus of stability, with sufficient power to ensure a breathing space in which the building of a more extensive organization may proceed with due care and circumspection.

There can be no doubt either that great difficulties will have to be overcome to establish a new European order; or as to the necessity of establishing some effective form of international co-operation, whether in a federal system or some modification of the League system. The plans for rebuilding Europe must be well thought out and carefully laid long before the opportunity of rebuilding arises. If Europe is to pass from an international system of conflict and war to one of law and co-operation, the machinery of its organiza-

tion, as Mr. L. Woolf truly remarks in "The War for Peace", must be such as encourages the growth of the psychology of internationalism at the expense of the psychology of nationalism. This attitude forms the starting-point indeed for the offensive propaganda outlined alike by Mr. Williams in "War by Revolution" and in the pamphlet "How We Shall Win" issued by Federal Union[3]. We can only hope to play our full part as champion of freedom and of that part of mankind's great heritage which derives from the creative powers of individuality and respect for human personality when we can show the world that we can offer a programme of freedom and reconstruction to meet twentieth-century needs.

[1] War by Revolution. F. Williams. Pp. 171. (London: George Routledge and Sons, Ltd., 1940.) 5s. net.

[2] World Order Papers. First Series. Pp. 176. (London: Royal Institute of International Affairs, 1940.) 3s. 6d. net.

[3] "How We Shall Win". (The Federal Union, 44 Gordon Square London, W.C.1.)

QUI S'ACCUSE S'ACQUITTE

A Mathematician's Apology

By G. H. Hardy. Pp. vii + 94. (Cambridge: At the University Press, 1940.) 3s. 6d. net.

THIS is a slight book. From such cloistral clowning the world sickens. It purports to be an apology for a life misspent in mathematics and for the sort of mathematics on which it has been misspent—'real' mathematics as the entirely useless and to the 'real' mathematician the more profound part, in contradistinction to the 'trivial' part, in the culprit's view ugly in some sort of direct ratio to its usefulness. "Anyone who defends his subject will find that he is defending himself," and the last chapter is autobiographical. The court is of opinion that no such charge ought ever to have been or ever has been brought, and that it is unwise for the defendant to undertake the conduct of his own prosecution.

It is a personal vindication—much in the spirit an artist might confide in the public—defending himself and his particular clique, the 'real' artists*, from a possible charge of wasting their talent and explaining their curious canons of beauty and ugliness. As he himself states, few subjects are more popular than mathematics, and probably, if the truth were known, more people are interested in it than in music; there are masses of chess players in every country and chess problems are "the hymn tunes of mathematics"; it pleases even men who have used disparaging language about it; and in this shameless pastime few could rival the author. "School", "Hogben", "repulsively ugly", "intolerably dull" are his synonyms for "trivial" in dealing with the less mystical parts of it. Of the other sort one gets the impression that their real place is neither a university, technical college nor art school, but a place of worship. Naturally he is a little more enthusiastic about "mathematical physics, a splendid subject with tremendous problems where the finest imaginations have run riot". As regards what he calls "atomic physics", before it fell among mathematicians it was called radioactivity, and was not altogether without a certain crude loveliness, as it sprang from chemistry, physics and geology, almost full grown. But since it entered the beauty-parlour of $\sqrt{-1}$—for the benefit of the unlearned, a talisman that generalizes gyration and getting there—its progress could scarcely be beaten by a young puppy chasing its own tail.

'Imaginary' universes are so much more beautiful than this stupidly constructed 'real' one, according to the author, and if by 'real' he means the Aunt Sallys stuck up and knocked down at successive annual science junketings in the attempt to get physical science into a mathematical strait-jacket, who would deny him? His chair as a collection of whirling electrons, for example, is not a little moth-eaten, for matter re-materialized long since, and is at the moment said to be mainly made up of neutrons. But the spectacle of science also and already beginning to grin through a horse-collar at itself in its vanity bag must have warmed, within their protective endowments, the mummified hearts of all Olympus' faded hierarchy. Most scientists, however, still believe that the saner outlook on Nature inaugurated by the experimental sciences does reveal the real universe, and that it is not stupidly constructed. Those of them duped by mathematical fantasy are to be put up with rather than pukkha'd.

But there would be a graver charge to answer if the defendant had not constituted himself counsel for his own prosecution, on the question of the relative harmlessness, beauty, utility and so on of trivial and make-believe mathematics. Counting and calculation are good servants, capable too, like art and music, of giving pleasure

* The student should make himself thoroughly familiar at an early stage with this simple method, known even in antiquity, of raising the second order of small quantities to Pukkha magnitude, as until proficiency is attained his progress will be laborious.

to those so minded as well as to professional performers; but in a world ruled by the counting-house rather than by physical and biological laws, they are bloody masters. The Hindu mathematicians, to whom we owe the first use of imaginary negative quantities, justified them by their analogy to debts. They had not then risen to the heights of being able to think in minus pigs. They used them simply to denote a diminishment of the number of positive pigs, which the then elementary conception of common sense demanded had first to be taken for granted. But they put into the hands of the eternal word-spinners a weapon able to falsify physical accountancy and send a scientific civilization off the rails. Yet this incredible little book is largely a homily on the purity and beauty of mathematical philosophy, which thanks itself it is not like common sciences, trivial mathematics, engineering and chemistry, being preserved by its very uselessness from the evil association of war. Make-believe mathematics has led to make-believe finance, and in relative destructive power the chemist's bomb is a squib by comparison with an imaginary quantity divorced from common sense.

The humble road surveyors who converted the abacus into a calculating machine, and the primitive mule-track into the *autobahn*, stuck up a mirror marking the end of it to assist them in their triangulations. They found it such an assistance that they failed completely to understand its danger to road-users or the necessity of putting up a warning sign. In time they became philosophers and roundly declared that what was behind the looking-glass was much more real than what was in front of it and that there "one at least of our nobler impulses could escape the dreary exile of the actual world". Now when a high-power civilization has crashed straight into it they congratulate themselves that theirs at least is "a harmless and innocent occupation".

This book is also in some way a repartee to Hogben's "Mathematics for the Million". For the benefit of those acquainted with neither, it may be said that Hogben, winnowing perhaps the only grain of truth in Marxism, sees in the social environment and needs the inseminator of mathematical discovery, whereas Hardy confesses, as if to a defect, that "there is no mathematician so pure that he feels no interest at all in the physical world, but in so far as he succumbs to it he is abandoning his purely mathematical position". More briefly the "real" mathematician is a religious maniac, and who can be expected to subscribe to the view that a religion, whatever it is, is "harmless"? Marxism certainly is not, and the only one approaching this one in its renunciation of the world is Buddhism. Under it, in India, the multitudes starve and swarm, a curious biological correlation, to which attention was directed by Adam Smith in the case of the poor Scottish crofters, but in India operating in a warmer climate. On the other hand, *our* efforts to subordinate physical to mathematical reality are at the moment taking a stormier course; but in the heat of conflict no one is likely to remember the proverb of the devil among the tailors.

Hardy's view that the motive of research is not conscious intention to benefit humanity, but intellectual curiosity, pride of craftsmanship and ambition will, of course, be generally endorsed in research circles; but it is not inconsistent with detachment having proved sterilizing and necessity stimulating, nor with the direction of discovery being dictated by the prevalent trend of social inquiry. But his paradox that the useful subjects are just those most useless to learn, "a little chemistry or physiology having no value at all in ordinary life", their utility being confined to their practice by the few who specialize in them, they themselves being educationally useless, is typical of the effects on education of any religion with its inverted order of sequence of body, mind and soul. If children had been taught at their mothers' knee they were primarily little internal combustion engines, which, scientifically fed and maintained, would in time develop mind and soul and beget other children, mathematicians and other magicians would not find it so easy to get across their slanders. Chemistry at least would have come into its own. Instead of making bombs it would be esteemed for its creative rather than destructive aspect. At present it is a mere butler to the 'real' philosopher, and jackal to the riotous imagination of the mirror-image of that king of beasts.

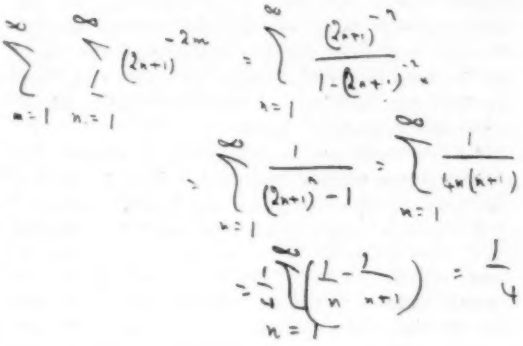
On this burning question of war, both Hardy, his critics whose criticism he thinks worth a special note at the end, and his opposite number are quite conventional. Hogben's "civilized people regarded war as a degenerate act of piracy" seems from a biologist and historian somewhat superficial, though it was written some years before the present struggle for existence started. But Hardy, in the midst of it, can write about "evil" chemistry without specifying whether by evil he means making good ammunition or bad. "When the world is mad, a man may find in mathematics an incomparable anodyne" has not apparently any reference to Archimedes. Surely in these times a little appreciation of the military virtues, rather than the conventional vilification of the profession of arms, is called for by religious people of all sorts, especially since their sort of "education" is really at the bottom of the whole tragedy, and the chemist's bombs and poison-gas are such a heaven-sent whipping boy for their own.

To the experimental scientist, Hardy's treatment of the nature of mathematical reality and his proof—from the primeness of a number—of it having external existence independent of the mind will be of interest. But as a guide he is as unreliable as the more popular exponents, and one gets the impression that outside his special subject—prime numbers—he can know little of it and cares less. He is merely a little more clever in concealing how the reader, usually by some pretty analogy, which no one could describe as mathematical, is made to take the false step himself. Thus we find before the proof from primeness, just alluded to, mathematical reality extended already to imaginary "geometries", the whole question at issue being begged by a footnote (p. 64. * "We must of course, for the purposes of this discussion, count as pure geometry what mathematicians call 'analytical' geometry"), leaving the reader to infer that he could prove the independent existence of mathematical reality as easily for a negative prime as for a positive one. Discussing the complete abstract generality of mathematical concepts, he follows Whitehead in saying they refer to "just any old things". Does that mean none? For that is what *in practice* it has undoubtedly come to mean. But 317 nothings are the same mathematically as any other number of nothings or none. "It is obvious that irrationals are uninteresting to an engineer, since he is concerned only with approximations and all approximations are rational". As engineers deal with the measurement of continuous variables in the inanimate world, one would have thought it the other way, that they were interested in irrationals, as in this science integers and their ratio are positions without feature on a continuous line ending in a mirror, just as a biologist dealing with number for enumeration in the animate world has no use for fractions, rational or irrational.

In fact, the profounder the mathematician, when he reverts to everyday language, the less he seems able to talk it. They bore everyone to tears with their panegyrics over the profundity of the extension of the use of number from enumeration to calculation, which robbed them of any magic. They seem to treasure their most outstanding failures as remarkable achievements, and they impose on their wretched students a degree of formal rigour paralysing to the inventive capacity. Bertrand Russell's apocryphal dream, recorded in these pages, that he was in a university library about A.D. 2100 watching the assistant dumping all the old books off the shelves into a bucket and pausing a little over the last surviving copy of the "Principia Mathematica", is to-day at Oxford no dream but fact. But it is not the assistants—they weary of retrieving them from the cellars—it is prim and proper Prof. Hardy and his fellow purists, protecting the tender minds of their budding prodigies from loose thinking. They really should be barred from access to the shelves if their real purpose is to hunt out mathematical pornography. But there is a worse fate for a grand old mathematical text-book than the dump. It may be considered worth re-editing.

FREDERICK SODDY.

Postscript. The reviewer may have laid himself open to the retort that he has given no indication of what he considers real mathematics really is. As Huxley remarked, when you want to test the strength of a gymnast you do not ask him to lift a 200-lb. pair of dumbbells (such, for example, as is being dealt with in the hieroglyphics on the dust-sheet of this book, from "Asymptotic Formulæ in Combinatory Analysis" by G. H. Hardy and S. Ramanujan, which the publishers have thought the best way of frightening the public into buying it), but a 10-lb. Indian club *to see what he can do with it.*



On a glorious summer afternoon in 1931, misspent in a way for which even the author could scarcely apologize, attending a faculty meeting, to improve the anything but shining hour of imprisonment the reviewer slipped across a note to the author, demanding the sum of all the reciprocals of each of all the odd integers, except unity, raised to the power of each of all the even integers, a question which the veriest tyro must admit is scarcely up to scholarship standard. After a surprised and concentrated stare of disgust at this common and probably poisonous insect, he started jabbing it with a pencil, viciously but cautiously at first, then with lightning ferocity as he chased it down the paper to the kill, and *in an incredibly short space of time* flung back the dead body here reproduced.

F. S.

TREES OF MALAYA

Wayside Trees of Malaya
By E. J. H. Corner. Vol. I. Pp. vii + 770. Vol. 2. Pp. ii + 228 plates. (Singapore: Government Printing Office, 1940). 10 dollars.

IT is, we believe, unique to find monkeys co-operating with a botanist in collecting flowering and fruiting specimens of trees for botanical investigation. This, however, has been done in Malaya by Mr. Corner, the author of the very interesting book under review, and his trained Berok monkeys, one of which is figured on the cover of the book, have provided him with much valuable material which otherwise might have been unattainable.

Some 950 species of Malayan "wayside" trees are described, and keys are provided for running them down to their families and genera. Anyone, therefore, who is interested in the trees, and is not a botanist, should be able to determine them without much difficulty, more especially as the distinguishing characters selected can be readily observed and are available throughout the year. The book is greatly enhanced by more than 250 excellent illustrations of different trees, which comprise the second volume.

The first volume consists mainly of descriptions of the various trees, accompanied often by useful text figures of flowers, fruits, and leaves, and keys to the genera and species, and much interesting information is given about the trees and their uses, and also about the vegetation of Malaya.

The book, in addition, includes a descriptive account of trees and how to name them. Forty pages are occupied by the elaborate keys, which are constructed on somewhat original lines. Mr. Corner has, in some cases, sacrificed clearness and accuracy for the sake of brevity in his constant use of the words "not so" as the alternative phrase in the couplet of distinguishing characters. In the first place it is not always easy to appreciate to what it applies, and in many cases it certainly does not apply to the whole of the statement with which it is contrasted.

Another unusual feature of the book is the arrangement of the families and the genera in alphabetical order. This may serve a useful purpose, but it is very disturbing to the botanist, since it brings into juxtaposition families wholly unrelated to one another. The Gymnosperms, however, are relegated to the end of the volume.

The book is provided with excellent indexes of English, Malay, and Latin names, and the inclusion of derivations of the generic and specific names is very welcome.

The volumes are a credit to the Government Printing Office, Singapore. The printing of the text and the reproduction of the fine photographs leave nothing to be desired.

A. W. HILL.

AUSTRALIAN SHARKS AND RAYS

The Fishes of Australia.
Part I: The Sharks, Rays, Devil-Fish and other Primitive Fishes of Australia and New Zealand. By Gilbert Percy Whitley. (Australian Zoological Handbook). Pp. 280. (Sydney: Royal Zoological Society of New South Wales, 1940.) 7*s.* 6*d.*

THIS useful handbook deals, not only with the Selachians (sharks, rays and chimaeras) of the seas of Australia and New Zealand, but also with creatures such as the lancelets, lampreys and hag-fishes, and the unique lung-fish of Queensland. It is complete in itself, but is designed to form the first of a series of volumes on the fishes of Australia, which, when complete, should go far towards providing a long-standing desideratum. Within the compass of some 160 pages, the author has managed to include a brief description and figure of every known species of shark and ray, together with notes on its local range, maximum size attained, and so on. It is perhaps to be regretted that keys are not provided to assist identification of specimens; but the excellence of most of the illustrations, based almost entirely upon authentic local specimens, should serve to compensate for this omission. There can be little doubt that the intelligent reader making use of the systematic section of this book should have very little difficulty in determining most of the fishes likely to come to hand.

In addition to the systematic part, however, Mr. Whitley has managed to bring together a mass of valuable information concerning sharks and rays in general, which is presented in a comprehensive and interesting manner in the first sixty-seven pages of his book. This covers not only the breeding

habits, development, anatomy, teeth, food, and so on, but also more unusual subjects such as sharks in mythology, sharks in captivity, their commercial uses, and their attacks on man. The section dealing with shark attacks and tragedies is of special interest, although it makes grim reading. The correlation between the temperature of the sea, with the consequent popularity of swimming as a sport and the extension of the bathing season, and the liability of man to attacks from sharks is stressed, and the comparative rarity of such tragedies in the cooler waters of Britain explained.

The chief criticism of this book is concerned with its nomenclatorial features. The author's fondness for minute generic and subgeneric groupings, and for pouring endless new names into the already overburdened ichthyological synonymies, is well known, and has caused considerable concern to workers on fishes in all parts of the world. The more conservative reader will be more than a little puzzled by the names applied to familiar Australian sharks and rays. It will come as a shock, for example, to find the closely related species of spiny dogfishes, referred by most workers to the Linnæan genus Squalus, here designated *Flakeus megalops*, *Flakeus griffini*, *Koinga whitleyi*, *Koinga kirki*, etc. Again, the spotted dogfishes have been regarded by a distinguished European authority as constituting a single genus (Scyliorhinus), although others would be willing to recognize some four natural groups as genera : in the present work the Australian species alone bear six different generic names. The introduction of still more new specific, subgeneric and generic names in this book, which is admittedly of a semi-popular nature, is to be deprecated.

J. R. NORMAN.

METAPHYSICS REDISCOVERED

An Essay on Metaphysics

By R. G. Collingwood. (Philosophical Essays, Vol. 2.) Pp. x+354. (Oxford : Clarendon Press ; London : Oxford University Press, 1940.) 18*s.* net.

IN this book Prof. Collingwood is trying not to redefine metaphysics but to define it truly. That is to say, he is setting himself the task of elucidating its essential nature—that by which it has had significance for every age in which it has flourished. His book is therefore an apology for metaphysics rather than for metaphysicians. Indeed, as is to be expected from its aim, it also provides an apology for what the author terms "progressive anti-metaphysics" ; that is, the reaction experienced by living minds at any given time against the work produced by those professional thinkers who have the prescriptive right to be called metaphysicians, but who do not clearly understand their work. "It is only confusion as to what he is about," says the author, "that makes the metaphysician's work harder than that of other scientists" (p. 84). For metaphysics is essentially a historical science ; and it is this aspect of its definition which is so liable to be forgotten.

The first part is concerned with the work of definition. Taking the metaphysic of Aristotle, the author shows that this reveals two possible definitions : (1) that metaphysics is the science of pure being ; (2) that it is the science which deals with the absolute presuppositions underlying ordinary science. He disproves (1) on the ground that it is a contradiction in terms ; for the universal of pure being is the limiting case of the abstractive process, while it is the function of a science to investigate the particular—a statement which may lead some philosophers to argue that, though undoubtedly true of modern science, it does not necessarily define science as the Greeks understood it ; and that therefore the contradiction is convincing only if science is understood in the modern sense. Working on the second formula, the author goes on to a very valuable chapter on the nature of presuppositions, distinguishing between those which are relative and those which are absolute. Absolute presuppositions can never be answers to questions, because all questions involve some sort of presupposition. Hence the distinction of truth and falsity cannot apply to absolute presuppositions ; that is, far from being propositions themselves, they form a condition necessary to all propositions. Going on to study the nature of absolute presuppositions, Prof. Collingwood comes to the inevitable conclusion that metaphysics is "the attempt to find out what absolute presuppositions have been made by this or that person or group of persons, on this or that occasion or group of occasions, in the course of this or that piece of thinking" (p. 47). It is its nature as a *historical* science which decisively differentiates metaphysics from theology. Theology sets out presuppositions which are to be accepted by faith : metaphysics studies historically those presuppositions which are in fact accepted in each successive era of thought. As regards the immunity of their subject-matter from examination as to its truth or falsity, each agrees.

The second part of Prof. Collingwood's book is concerned with anti-metaphysics and pseudo-metaphysics. Anti-metaphysics may be progressive, reactionary, or irrationalist; and pseudo-metaphysics confuses absolute with relative presuppositions. In the light of these distinctions, psychology is considered as anti-metaphysics and as the pseudo-science of thought; but it is a pity that Prof. Collingwood, in common with most philosophers, judges the present science by its philosophical antecedents, while it is a characteristic of modern psychology that those antecedents are nominal only. Is not the author here falling into one of the very pitfalls which he has hitherto stated to be a source of confusion to metaphysicians? Many psychologists certainly fall under the heading of anti-metaphysicians—but *progressive* anti-metaphysicians. Is it not the task of the metaphysician to examine the presuppositions of psychology as it stands to-day, rather than to judge it in the light of outworn definitions and a misleading heredity?

The third part of the book under notice is devoted to examples and illustrations based on the ideas of the first two parts. For example, there is an examination of the relationship between the European "scientific frame of mind" and its religious institutions, which, says Prof. Collingwood, are the guardians of the presuppositions upon which it has flourished. The latter part of the book is devoted to an examination of the philosophy of Kant, and an analysis of the idea of causation.

It is a characteristic of living works that they themselves are illustrations of the principles which they express in words. This is eminently true of Prof. Collingwood's very stimulating book. In his own words, "for a man of the twentieth century it is inexcusable to take a metaphysician's word for what he is doing. You must settle that question yourself by studying his works" (p. 235). It is not therefore surprising to find here illustrated the difficulties which beset the twentieth century metaphysician faced with the problem of modern psychology.

B. M. BALDWIN.

WORLD HISTORY

The Golden Ages of History

By Joseph McCabe. Pp. xi+242. (London: Watts and Co., Ltd., 1940). 10*s*. 6*d*. net.

IT is surely rather a mistake to use the term 'Golden Ages' as if it had any generally accepted or scientific meaning. It is rather like so many of the current slang words about an airman's achievements. Something or somebody strikes the speaker as exceptionally good, and he uses the phrase to characterize fifty or a hundred years of history or a long and exciting flight. In this way Louis XIV managed to gild some hundred years of French history, Queen Victoria not quite so much, and Queen Elizabeth still less. There is thus a profound fallacy in comparing or using the same terms of Queen Elizabeth's reign and the hundreds of years of China's flowering under the Tang and other emperors. Readers will also be inclined to jib at the exalted position assigned to the last hundred years of European history, considering that it includes at least five periods of disastrous fighting, and that it has culminated in the present War, which leaves us in grave doubt as to how much of Mr. McCabe's quite justly lauded triumph of science will survive.

These faults or queries about the book will strike every reader as soon as he opens it. But it would be a grave mistake to discard the wisdom which is often intermingled with the author's fallacies and prejudices. In the first place, it is a useful thing to have in one compact volume the mass of historical facts concealed in learned tomes, and to have them spread out chronologically, even if not in equal measure. British people are shockingly ignorant of history as a whole. It takes a war like the present to arouse us to a sense of our own historical greatness, and much of Mr. McCabe's book is entirely unknown, even to schools or scholars who 'do well' or are 'keen about their history'. It is a ridiculous and quite unnecessary fault in our school curricula which derives from the medieval fact that history was regarded merely as the chronicle of kings and popes down to nearly five or six hundred years ago. Summaries or conspectuses of the whole were always wanted, just as a globe has always been a necessary part of every school's equipment. Here is the place for such books as that of Mr. McCabe and of Mr. H. G. Wells. We would only plead—and every teacher will agree—that the 'book-globe' of history should be freer from prejudice, should aim at a simpler and less highly coloured picture than Mr. McCabe gives.

One might be allowed to suggest two or three of the essential features of such a 'general history'. It should be comprehensive, as Mr. McCabe has tried to make his. There is no acceptable reason why the outlines of Chinese or Indian history should be

completely ignored. But it may be fairly at the same time rather more Western than Eastern, considering that, in the main, Westerners will read it, and that Western methods of government and education continue to spread over the world. Then there are two points on which I am happy to agree entirely with Mr. McCabe. The first is that our view of history from the first should cover all classes, and not the eminent or wealthy who fill the larger place in the older books. This does not mean that art or beautiful things should be ignored, but that they should be regarded as part of the patrimony of the poor as well as of the rich. The second, and perhaps most important of all the aspects of history, is the growth of knowledge and the use of knowledge for the welfare of mankind. On this point Mr. McCabe is sound and strong. What he needs is a kindlier and truer realization of the place of religion in history, and the value of religion to the poor as well as the aspiring, both in the East and the West.

F. S. MARVIN.

FROM COUNTING TO THE CONTINUUM

Number: the Language of Science
By Prof. Tobias Dantzig. Second revised and enlarged edition, based on the third American edition. Pp. xi+320+11 plates. (London: George Allen and Unwin, Ltd., 1940). 10*s*. net.

PROF. DANTZIG'S title raised my hopes. As a biometrician concerned in an attempt to substitute mathematical expressions for such useful, if slightly vague, biological expressions as race, type, heredity, and variation, I hoped that he might show why science is inevitably and progressively doomed to use mathematics as its language. He might even furnish me with arguments to be used on my non-mathematical colleagues.

I was disappointed. The book is written from a historical angle, and shows how the concept of number grew from the stage of finger-counting to transcendental and complex finite numbers, and transfinite cardinals. Practically nothing is said of further generalizations such as vectors and Kronecker ideals, though the former at least have more place in the language of science than transfinite cardinals.

The historical survey is full of interesting quotations, and illustrated by an excellent series of portraits, but it is somewhat over-simplified. Thus, on p. 30 we read that the Greeks did not create even a rudimentary algebra, and that positional numeration originated in India. This enables the author to evade the very interesting questions of why Diophantus's algebra remained rudimentary, and why the Babylonians, who used positional numeration to some extent, did not invent zero or the decimal point.

The account of Cantor's work is particularly clear. But the same cannot be said for the treatment of mathematical reasoning. On p. 66 we read that a conclusion is logically flawless, if "we have examined our premises and found them free from contradictions". Surely a less acquaintance than Prof. Dantzig's with the history of mathematics should have made him pause before he wrote this sentence. For two thousand years Euclid's axioms were supposed to be free from contradictions. But Prof. Dantzig's Chapter xi on transfinite numbers is full of awful warnings against pushing the assertion that the whole exceeds the part beyond its proper domain; and quite recently Gödel has shown that no system of axioms can be proved to be free from contradictions. It can be tested for hidden contradictions, but a failure to find them is no proof that it is logically flawless.

This book has its proper place, in the library of amateurs of mathematics, or of schoolmasters who wish to make elementary mathematics as interesting as possible. But it does not tell us why in some periods mathematics develops in response to the demands of science, and at other times independently. Thus, the first transcendental functions were invented because observations became sufficiently accurate to make them valuable. Then function theory ran ahead of practice. To-day science has caught up mathematics in many fields, and unfortunate biologists like Sewall Wright and myself are compelled to investigate probability distributions (one of the most interesting generalizations of number) because the mathematicians have not yet done the work for us.

Prof. Hogben, to take a recent and justifiably well-known example, has told us how mathematics grew up in response to scientific demands. Prof. Dantzig tells us something of how it grew under the stimulus of its own internal contradictions. I am waiting for an author who will combine these two points of view, and give us a real philosophy of mathematical progress; and I hope that when such a book is written it will be better bound than "Number".

J. B. S. HALDANE.

The Commissioning of Electrical Plant and Associated Problems

By R. C. H. Richardson. (Monographs on Electrical Engineering, Vol. 5.) Pp. xvi+363. (London: Chapman and Hall, Ltd., 1938.) 21*s.* net.

ENGINEERS on the whole do not exhibit reticence when recounting difficulties they may have experienced during the commissioning of electrical machinery and plant; but when it comes to publishing such an account, even if time and circumstances permit, the greater the diversity and interest of these experiences the less are they likely to appear in print. It is not surprising that this dearth of literature leads to expectations being aroused, perhaps unduly, if at last what appears to be a record of personal experiences is published.

The book under review gives rise to a reaction which is one of disappointment, for it is distinctly lacking both as regards personal appeal and the recording of instances of the surmounting of 'teething troubles'. In the first place, someone ought to have persuaded the author to discard elementary theory, such as the derivation of the equivalent circuit of a transformer or the elementary theory of vectors, which is to be found in so many existing text-books, and utilize the space thus gained for more meaty matter. Not a few cases of trouble from 'noise' have been encountered when commissioning transformers; yet, in this book, noise does not figure in the index or in the text. The vibration and noise of machinery, it is true, are mentioned on p. 84, but methods of measurement, treatment or cure are not described.

Mathematical treatment has been avoided, but at a price, for instead of being an advanced treatise the book is largely descriptive though lacking photographic illustrations. The text is supported by numerous line diagrams and there is a short bibliography, but it is considered that the list of books given is totally inadequate. Such a serious trouble as that of 'hunting' is not dealt with in the section on alternators and is not referred to in the bibliography.

In favour of the book it may be said that it would serve to guide a reader to the many matters which he may have to study deeply if he is to have confidence in commissioning machinery and plant.

Psychology, Psychotherapy and Evangelicalism

By Prof. J. G. McKenzie. Pp. xiii+238. (London: George Allen and Unwin, Ltd., 1940.) 10*s.* 6*d.* net.

PSYCHO-THERAPEUTIC techniques provide new means for a study of the various types of religious experience, and Prof. McKenzie applies them to the study of Evangelicalism. For examining it he has the important qualification of having shared in the evangelical experience himself. Evangelical Christianity has suffered much from the dramatizing tendencies of its exponents; they have laboured to heighten the vividness of the colour scheme, and the result has been that they have presented the world with something fantastic. The actual facts are more sober. Not all evangelicals are of the 'twice-born' type, nor does the root and centre of their religious experience invariably lie in mystical states of consciousness. Anxious to induce in their converts a conviction of sin, evangelical teachers have sought to deepen their sense of guilt. Prof. McKenzie writes at length and with great insight upon this point, making a clear distinction between "the true sense of sin which involves repentance, and the sense of guilt which is always the outcome of repression and must be removed before repentance and forgiveness can take place". He holds that the well-meant attempt to deepen the sense of guilt "not only does damage to the personality but is a hindrance to evangelical Christianity".

In a most interesting section on "The Meaning of Sin", Prof. McKenzie makes a distinction between "two absolutely different types of personality": the "Ego-centred" and the "Object-centred". The former "makes himself his own main purpose", consciously or unconsciously. The popular notion that virtue consists in "the integration of the personality" is not accepted by the author, for "This integration is not a moral process in itself". The quality of the integrated self depends "on what moral principle has integrated it". Prof. McKenzie has a most illuminating section upon forgiveness; and indeed his book as a whole is so full of valuable material that it will repay study not only by psychologists but also by theologians and ministers of religion. J. C. H.

A Pocket Medical Dictionary

Compiled by Lois Oakes, assisted by Thos. B. Davie. Fourth edition. Pp. xx+409. (Edinburgh: E. and S. Livingstone, 1940.) 3*s.* 6*d.* net.

THE distinctive features of this popular little book, the modest price of which makes it specially suitable for medical students and nurses, are the addition of many new words and the deletion of those no longer current, an appendix on first aid, and an anatomical chart of the human body. We have noticed only one serious mistake, namely, "rotheln" (without an *umlaut*) stated to be the same as "measles", while the following words should be inserted in the next edition: "barbiturates", "erysipeloid", "erythema infectiosum", "fourth disease" and "tularæmia".

Diathermie chirurgicale

Par Dr. C. A. Arraud. (Les actualités physiothérapiques, 1: Électrothérapie, 7). Pp. iv+216. (Paris: Gauthier-Villars, 1939.) 50 francs.

THIS clear and concise little work by Dr. C. A. Arraud, assistant in physiotherapy at the Hôtel Dieu, Paris, is divided into two main parts. In the first, which is introductory, the author deals with the historical aspects of surgical diathermy, the various currents employed, and the choice of an apparatus, particularly those of French origin. The second part is concerned with the employment of surgical diathermy in cancer and in disorders of various systems, such as diseases of the skin, gynæcology, urology, diseases of the alimentary system, neurology, respiratory diseases, otorhinolaryngology and ophthalmology.

The Grasses of Mauritius and Rodriguez

By C. E. Hubbard and Dr. R. E. Vaughan. Pp. 128. (Mauritius: Director of Agriculture; London: The Crown Agents for the Colonies, 1940). 4*s*. 6*d*.; 3 rupees.

MAURITIUS and Rodriguez, alas, so far as their native vegetation is concerned, afford sad examples of the results of human activity in developing a country for its economic possibilities. Sugar cane cultivation and plantations of other exotics have changed the face of the islands with the result that, in place of the original forests of indigenous trees, scrubs and thickets now occupy much of the ground not devoted to plantations. In this change the native grasses have naturally suffered, and many exotic ones have been introduced, and, as is so often the case, have tended to oust the native species, so that, except by studying carefully the habitat of a particular species and its distribution in the island, it is by no means easy to say whether a particular genus or species is a native or not. Seven endemic species are known, but they may not now all exist. Interesting particulars of the indigenous grasses are given in the introduction, and full descriptions, with useful figures of some of them, form the bulk of this useful volume. Excellent keys to the tribes and genera precede the descriptions, and notes are given on the economic uses of the native grasses. There is also an account of the structure and classification of grasses with good text-figures, which should enable anyone to become familiar with the structure of the grass flower and the points used in describing and classifying the genera and species.

The preparation of this account is a valuable piece of co-operative work by the field botanist, with an extensive knowledge of the ecological conditions in Mauritius and Rodriguez, and the herbarium botanist, who has made a critical examination of the specimens, and from his extensive knowledge of the world's grasses has been able to determine which may be indigenous and which introduced.

Since it is becoming necessary to convert waste areas, now dominated by scrub, into grazing lands and pastures, an exact knowledge of the grasses which occur in the islands and of their economic value is most desirable.

The authors are to be congratulated in having produced so useful a piece of work, and also the Government of Mauritius for their wisdom in making its preparation possible, both by their encouragement and by a grant towards its publication.

A. W. H.

Elektrische Höchstspannungen

Von Dr. A. Bouwers. (Technische Physik in Einzeldarstellungen, herausgegeben von W. Meissner und G. Holst, Band 1.) Pp. ix+344. (Berlin: Julius Springer, 1939.) 31.20 gold marks.

THIS book is highly recommended to anyone interested in the technique of high-voltage or high-frequency apparatus and testing, or who is seeking a comprehensive outline of current practice in this rapidly developing branch of electrical technology. It is very well illustrated with 239 explanatory diagrams and photographic reproductions of actual apparatus of recent construction. There is a valuable bibliography, containing 324 references, and an excellent index.

The opening sections are devoted to the theory of high-voltage transformers, cascade connexions, high-frequency transformers, coupled circuits and surge generators, with illustrations from American and Continental practice. The Van de Graaff generator, the cyclotron and apparatus for "Der Blitz" are described. Parts 2 and 3 deal with the theory of electric fields, associated with this class of apparatus, and insulating media respectively, and are supported by good illustrations of modern terminal constructions, bushings and condensers. Valve generators of the Marx and other types are described in Part 4, and the remaining two sections of the book outline, in brief, methods and apparatus for measurements, rectifier tubes, auxiliary apparatus, feeder-circuits and their lay-out for radiography. The latter portion of the book rather tails off, so that it cannot be recommended as a treatise for radiographic technology. The printing and general production of the book leaves nothing to be desired, but its price is excessive.

Concise General Astronomy

By the Rev. O. R. Walkey and Dr. H. Subramania Aiyar. Pp. vii+442+8 plates. (Trivandrum: Sridhra Printing House, 1940.) n.p.

A FOREWORD in this book has been written by Sachivottama Sir C. P. Ramaswami Aiyar, Dewan of Travancore and Vice-Chancellor of the University of Travancore. It is claimed in this foreword that the work deals adequately though briefly with the new concepts as to space, time and relativity—a claim which is justified in spite of the fact that mathematical formulæ are practically omitted. Much important up-to-date information has been included in the text, and an excellent index greatly enhances the value of the book. The appendixes and tables—twenty-five altogether—supply a large amount of useful material in a very concise form on various astronomical matters; some of these deal with Hindu astronomy and show how extensive was the Hindu knowledge of the subject. The work will fulfil its author's aim, "to rouse an intelligent interest in the sublime but generally ignored subject of Astronomy".

Hilfsbuch für das Sammeln und Präparieren der niederen Kryptogamen

Von Prof. Dr. Gustav Lindau. Zweite, neubearbeitete Auflage, von Prof. Dr. O. C. Schmidt. Pp. vii+93. (Berlin: Gebrüder Borntraeger, 1938.) 3.60 gold marks.

IN this useful little handbook, now in its second edition, an account is given of the methods to be employed in the collection and preparation, for herbaria and for subsequent examination, of the lower Cryptogams, sections being devoted to the special requirements of terrestrial, freshwater and marine algæ, myxomycetes, fungi, lichens, mosses and liverworts.

A REMARKABLE PAINTED CAVE ON THE ESTATE OF LESCAUX (MONTIGNAC, DORDOGNE)

BY PROF. THE ABBÉ HENRI BREUIL
COLLÈGE DE FRANCE

IN mid-September 1940, several young lads of Montignac, MM. Ravitat, Marsal, Quéroy, Cuëncas, and Estrégil, encouraged by a retired schoolmaster of the town, M. Laval, to explore underground passages in the neighbourhood, cleared out a shaft leading vertically from a plateau to the east of the town. This shaft had been filled up to prevent cattle falling in and only a narrow passage led to the bottom, ending in a hollow into which the young explorers slid after having enlarged it. Descending a slope of fallen boulders, they discovered that some of those fallen from the vault of the first hall were decorated with magnificent frescoes which continued down a narrow alley leading out of it. M. Estrégil made several sketches of these, which he showed to M. Laval, who was at first sceptical about them. Whereupon M. Maurice Thaon, a good sportsman and draughtsman, whom I had known since his childhood, and to whom, a few days earlier, I had shown the painted caves of Font-de-Gaume and La Mouthe, at Les Eyzies, was taken to the cave by the youthful discoverers, and brought careful drawings and some tracings to me.

His descriptions convinced me of the exceptional importance of the discovery. I therefore went to Montignac, where M. Laval, M. Parvan, bailiff of the proprietor, Madame la Comtesse Emm. de la Rochefoucault, and various distinguished people received me most kindly. I asked M. D. Peyrony, delegate of the Ministry of Fine Arts, to meet me there, and a three days' study enabled me to send a preliminary report to the Académie.

The cave in its present state consists of an oval entrance hall (20 m. × 10 m.) continuing in a narrow passage. In the second half of the hall and in the passage there are more than eighty paintings, chiefly on blocks fallen from the vault above. In a short gallery to the right, there are fewer; but this gallery leads to another lofty hall sloping steeply and leading on the left to a corridor with a high nave, shrinking to a slit of a passage, extremely narrow in parts.

Beyond the lofty hall is a well about 10 m. deep leading by a scramble on the opposite side to ascending galleries, as yet almost unexplored. In the high nave, engravings are generally superposed on paintings; but they are unaccompanied in the tortuous galleries; their great number and delicacy have prevented us from deciphering them adequately, as yet.

The paintings vary in size from 30 cm. to nearly 5 m.; they are of different technique, frequently superposed and restored.

(1) A single little hand outlined in red, with its arm, recalls the Aurignacian type of hands.

(2) Fine line drawings in red, of horses and stags.

(3) Bigger red line drawings, wide blotchy lines filled in with splashes here and there, representing a fairly big horse and bison; there are also some big bulls and stags covered over and swallowed up by other figures.

(4) Small and medium-sized red, black or sepia line drawings, or in a mixture of these tints more or less filled in with rather transparent sepia or red very much stomped spots. Black touches have often been added later, blending and denoting anatomical details or restoring the outline. A great many small horses, often with very heavy coats, and a great many stags, their antlers in twisted perspective, and one bear (?)

(5) Figures in red, medium-sized, softly dappled, being horses and oxen with small horns and slender build.

(6) Black wash combined with dappling, frequently used in restoration, or depicting single analogous animals.

(7) Two ibex, decorated with wide splotchy black bars.

(8) Stag's heads drawn with a fine black line.

(9) Enormous bulls with big horns, the biggest about 5 m. long, drawn in wide black lines, the colour spreading over the legs and horns and part of the head, the field inside the outline sprinkled with big spots, though usually only the head.

There are neither reindeer nor mammoth, and besides the animal figures there are a good many signs; rectangles barred lengthwise and across; five-pronged comb-shaped signs, chessboard patterns filled with big squares of flat wash, the colours arranged in varied ways, looking like coats

of arms; lances or javelins with a single barb; arrows, feathered on one side.

The foot of the well boasts a more unusual subject; to the left a black rhinoceros walks slowly away; in the centre, drawn in red, a half-conventionalized man is lying beside a javelin and a throwing stick. To the right, a sand-coloured bison outlined in black gazes at him; its entrails seem to be flowing out like a horse ripped open in a bull-fight. It looks like a scene in a prehistoric drama. Near the man a bird is perched on a post.

Though there may be many surprises in store when the engravings are studied, we can state already there are many horses, oxen, bison, two lions, and what seem like straw huts such as those at Altamira.

As regards the age of the engravings and paintings at Lescaux, the following are some suggestions.

In Dordogne, there are such blocks fallen on the hearths found in the Aurignacian levels and during the Perigordian epoch, in the rock shelters of Blanchard and Labattut (Sergeac) discovered by Monsieur Louis Didon. These blocks display big bichrome figures or the last of the black line drawings. This discovery permitted me to date as of pre-Solutrean age a few figures partially hidden under the big polychromes and black shaded paintings of Magdalenian age at Font de Gaume (Les Eyzies), Le Portel (Ariège) and Cabrerets (Lot), all of which have fine painted panels of that age. It is the same in the Cantabrian provinces; the beautiful Magdalenian frescoes of Altamira are obliterated by red line and red wash drawings, between these two black line drawings intrude.

At Cavalanes and La Haza there are only paintings in wide smudgy red lines, but at La Pasiega such paintings obliterate fine line drawings and have black drawings superposed. The stags and oxen of this ancient series have horns in twisted perspective as at Lescaux, and we have already remarked that this curious perspective is always seen in the open air art of the east of Spain from Lerida to Almeria. The only French examples are those in the rock shelter of Labattut (Sergeac) and the two at Portel (Ariège).

The similarity of the stags and oxen at Lescaux and those in the eastern Spanish art is sometimes so great that they become identical. M. Peyrony and I agree that the whole ensemble of Lescaux represents an art earlier than either the Magdalenian or Solutrean, and except in a few instances is attributable to levels later than the typical Aurignacian. As the much regretted Joseph Déchelette called Altamira "the Sixtine Chapel of Magdalenian art", so Lescaux represents with equal splendour that of the far more ancient Perigordian.

SEARCH FOR PETROLEUM IN AUSTRALIA

By H. B. MILNER

SIR EDMUND TEALE'S recent observations on oil occurrences in Gippsland, Eastern Victoria (a summary of which appears on p. 27 of this issue), reopen in critical circumstances two fundamental though wider questions: if there exist *commercial* petroleum reserves in the Commonwealth of Australia, where are they and why have they not long since been exploited? Now, if ever, is surely the time to realize such assets if they are not for ever to remain frozen.

For many years past, indeed, and since before the War of 1914–18, both casual and ordered search for oil pools in this continent have occupied the attention of pioneers, mining engineers, State, Territorial and Commonwealth Government Departments, also leading oil companies. The record is long, interesting, but in results bitterly disappointing. Even so, belief in possibilities still prevails in many quarters, fostered perhaps more by political and economic than by scientific premises. Let us first briefly review geological data.

The relationship of loci of major oilfields of the Eurasian continent to the Alpine geotectonic system is a firmly established and universally recognized fact. To take the relevant segment in terms of petroleum development, follow through Irak, Iran, North-West India, Assam, Burma, Dutch East Indies to New Guinea: these proved fields in disposition themselves trace those great Tertiary earth-movements responsible for their actual oil concentrations to-day. But equally the fundamentally resistant earth masses to the south, namely, Arabia, peninsular India and, be it noted, Australia, played a significant, if passive, part in restricting the influence of this diastrophism, being themselves practically unruffled in the process.

Thus any oil pools existing in Australia must at least lack the Alpine *cachet*, surely a most serious

disadvantage in that part of the globe which even the pernicious habit of wishful thinking cannot entirely overlook. In point of fact, structures impressed on these relatively static earth-masses tend to be epeirogenic and inimical to oil accumulation, even if the requisite mother-substance of petroleum is present in otherwise suitable sediments: witness the Tertiary deposits of Gippsland, almost entirely undisturbed in the sense we understand Iranian or Indo-Burman folding. Although this is all uninspiring re-statement of fact, it is surprising how often and how persistently it has been and still is disregarded.

Frankly, we must recognize that a large part of Australian territory is geologically unfavourable to localized petroleum segregation, especially in West, South Australia and Northern Territory. A fundamental Archæan and Proterozoic complex, counterpart of peninsular India, South Africa and Madagascar, constitutes not only the foundation but also much of the surface geology of this continent. Widespread developments of Palæozoic sediments sterile of oil, masses of Mesozoic epicontinental deposits, relatively undisturbed Tertiary rocks often obscured by thick Quaternary drift, a not inconsiderable development of oil shale in certain regions and an almost total absence of surface indications of petroleum throughout the continent, are basic factors to be contended with in any assessment of oil possibilities.

Even those districts offering some degree of encouragement in the past, for example, Central and Southern Queensland, Victoria, the Victoria – South Australia borderland and some tracts in Western Australia, if pertinently reviewed in proper perspective, fail, at least in my opinion, to raise much enthusiasm either now or for the future.

In Queensland, at Longreach, several boreholes put down for artesian water encountered hydrocarbon gases, small oil flows and mineral wax. Wells in the Permian at Hutton Creek and Arcadia found gas, though often supercharged with carbon dioxide. Work has recently been resumed at these places and deep tests have proved 'wet' gas. Natural gas at Roma, Southern Queensland, has been known for forty years or more, and associated light oil distillates have been refined and marketed on and off since 1927. More recent drilling at Mount Basset near Roma revealed only traces of oil and gas. So in spite of widespread exploration in this area over a protracted period of time, no main oil pool has yet been located, and subsurface conditions, so far as they are known at present, do not give grounds for hope that anything spectacular lies ahead of further developments, however extensive and far flung they may be.

Tests in New South Wales, for example, Kulnura and Mulgoa, produced negative results. Search has been carried out in the Hunter River Coal Basin, also in the extensive Mesozoic deposits of south-east Queensland and north-east New South Wales, again inconclusively. It would appear that the 'oil shales' (boghead) of the Coal Measures in this State provide a clue to prevailing hydrocarbon conditions, and petroleum, if present, is nothing more than an elusive, sporadic trickle. In the former connexion it should be mentioned that intensive development of the established oil-shale field at Glen Davis, Newnes, is, according to reports received early this year, proceeding on the basis of anticipated production of 10 million gallons of shale-oil per annum, believed capable of expansion to 30 million gallons if adequate Federal subsidy is forthcoming. If such development fulfils early hopes, then this source of fuel must necessarily be of the greatest possible importance to the Commonwealth in present circumstances, especially for the Navy and in the general scheme of national defence.

Eastern Victoria boasts the only producing oil wells in the Commonwealth, at Lakes Entrance, Gippsland district. Since discovery in 1924, an emulsified oil has been obtained from which in latter years an *annual* production of some 25,000 gallons (!) has been recovered. Association of oil with prolific artesian water is scarcely a healthy sign, although the Imray borehole indicated that oil and water sands were separated. The trouble with Lakes Entrance is that there is no natural pressure to cause flow of oil to the wells when the sands are penetrated; hence commercial production is impracticable either by drilling or pumping. It would appear to be equally impracticable to use the underlying water to flush out the oil. Some system of air repressuring might be tried as suggested by Sir Edmund Teale, but to do this satisfactorily means effective plugging of all producing and shut-down wells, to say nothing of a financial outlay of considerable dimensions.

Although it has been reported that some 150 million gallons of oil are available here, even if economically recovered, no petrol or fractions lighter than lubricating oil could apparently be refined from it. Is such an enterprise worth while even as a war-time measure? If there is a doubt about it now, how much more hazardous would be the project in peace-time. Sir Edmund makes out a good case for speedy consideration and action by Government and other interests concerned, but even so the chances of success are not impressive. Apart from Lakes Entrance, recent drilling activities at Lake Boga, Portland, and at Nelson came to naught, while another enterprise at Dutson showed no sign of oil or gas.

In the South Australia – Victoria borderland

country, the Tertiary deposits are alleged to contain some oil, but it is probably widely dispersed. Oil seepages reported from Glenelg River when followed up led to nothing. Prospecting carried out in this region seems to have been inspired by a widespread occurrence of bitumen along the whole southern coast of the continent, quite probably washed up by prevalent Antarctic tides.

In the Kimberley region of North-West Australia trials for oil were made at Nerrima, south-east of Broome, in 1939, but no oil or gas shows of consequence were encountered. Again, in his report on petroleum prospects of the Kimberley district of Western Australia and Northern Territory, made more than sixteen years ago, Dr. A. Wade wrote: ". . . the area could not have been less favourable from the point of view of prospecting for, or for the finding of, petroleum supplies. It is more suited to the prospector for gold and other minerals . . ." One cannot escape the feeling that this last remark applies to a far larger part of the continent than many people realize.

THE RUBBER RESEARCH INSTITUTE OF MALAYA

By Sir Geoffrey Evans, C.I.E.,

Royal Botanic Gardens, Kew

ABOUT ninety per cent of the rubber in the world is manufactured from the latex of the tropical tree *Hevea Braziliensis*, a native of the Amazon region of South America, but now cultivated on a plantation scale in Malaya, the Netherland Indies and Ceylon, which areas produce practically all the rubber of commerce. The story of how Sir Henry Wickham managed to secure seeds of this wild tree from Brazil in 1876, and its subsequent transfer, via Kew, to the Peredeniya Gardens in Ceylon, and thence to Malaya and the East Indies, is a fascinating one. Some of the original trees are still growing at Peredeniya. From these small beginnings, the vast plantations of the Far East have their inception. In Malaya alone the area under rubber amounted to more than three and a quarter million acres in 1937, and the exports to nearly 500,000 tons, valued at nearly 350 million Straits Settlement dollars.

The industry made enormous growth at the start; but like so many other plantation industries, it had, at a later stage, to face obstacles in the shape of lower prices and fluctuating markets following periods of over-production. The earlier planters merely cleared the forests and planted rubber and were content to collect the produce without devoting much attention to the methods of cultivation. In this respect rubber presented no difference from many other tropical plantation crops. A period of boom prices would result in the wholesale planting of areas, irrespective of soil and climatic conditions, but subsequent slumps, combined with acute competition, brought home to those interested in the industry the vital need for research and for control in the output. With the ramifications of the rubber restriction proceedings we are not concerned; but the progress of the research work is a subject worthy of more than passing note, in view of the thorough manner in which the need has been met.

In the years immediately succeeding the War of 1914–18, the pros and cons of the matter were thoroughly thrashed out by those vitally interested in the commodity, both in London and in Malaya, and their views crystallized into the idea that a research station was needed, which would be in a position to tackle the various problems that beset the industry. The problems were many. There was first the system of cultivation. It had been considered from the first that clean weeding was essential to the successful growth of the rubber tree; but tentative experiments made by the Agricultural Department had indicated that this system was not necessarily the best, and that it resulted in the loss of much soil through erosion. Sir Lewis Fermor, in a recent report on the mining industry of Malaya, hinted that possibly as much erosion had been caused by rubber planting as by tin mining operations, which had always hitherto been blamed. Nowadays one hastens to explain this is not the case, as cover crops are the usual practice on rubber estates and clean weeding has been abandoned, and with it much erosion has been checked.

The Rubber Research Institute of Malaya was at length organized and started work in September 1926, and, after the usual teething troubles which seem to be inevitable with institutions of this nature, it can now be considered to have fairly got into its stride. A study of the annual report for 1939 gives full indication of this, and a perusal

of the 277 pages will convince readers of the thorough way in which diverse and complex problems are being investigated.

The Institute is situated near Kuala Lumpur on a suitable site and is well equipped with a competent staff and excellent laboratories and land for experimental work. The scientific work is organized into several divisions dealing with botanical, soils and fertilizers, technological and pathological problems; there are also an experimental station of 1,850 acres at which work on cultural matters is investigated and experimental field plots laid out. In addition, there is much advisory work which preserves contact with the planters throughout the area. Close co-operation is maintained with the Rubber Research Scheme of Ceylon, with the London Advisory Committee, and other scientific institutions in Great Britain, and with the British Rubber Producers Research Association. This latter body is a part of the International Rubber Research Board, and by this means close liaison has been established with other research workers in Java and elsewhere.

In the Soils Division much has been accomplished in examining the various types of soil that occur in the peninsula with regard to their suitability for rubber growing and in ascertaining the manurial requirement for each type. Erosion problems are being examined, and the various systems of establishing new plantings by the relative methods of no burning versus light or normal burning are being tested. Whilst clean cultivation has now been abandoned, it has been found in practice that the establishment of permanent cover crops is not an easy matter on certain types of soil and are certainly difficult to maintain under mature rubber. Experiments in inoculation and manuring are, therefore, being made to try to get over the difficulty.

Valuable work by the Botanical Division has been done in the provision of improved planting material. The percentage of acreage replanted with higher yielding material is still considerably less than that of Java, as the Netherlands Indies started work of this nature several years before Malaya. Much progress has now been made in selecting high-yielding trees for bud wood, the number of high-yielding clones that have been tested and approved shows annual progress and the demand for the material is greater than the supply. The stage has now been reached when the yield from the present best proved clones is unlikely to be exceeded by selection from further high-yielding trees; resort is accordingly being made to pollination between high-yielding clones, and some of the seedling clones resulting are stated to be of high promise. Further valuable work by this division is being undertaken in testing different kinds of tapping systems, in the use of growth-promoting substances in the vegetative propagation of Hevea, and in stock-scion relationships. An interesting piece of work from which good results are expected, is in studies of the nutrition of the plant and also the connexion between leaf symptoms and various deficiencies.

The Pathological Division deals with pests and diseases. One of the chief troubles in newly planted areas is the control of root disease. Control of old stumps which are the focal points of the disease seems to be best assured by the use of sodium arsenite. An interesting piece of work is in the testing of nodule bacteria in connexion with the growth of cover crops, such as Pueraria and Centrosema, which, as mentioned above, are not always easy to establish.

The Chemical Division deals mainly in technological problems, in which direction the industry has made important advances in recent years. A new type of smoke house for crêpe rubber designed by the Institute has become popular and has been built on a number of estates. Other problems are connected with the shipment of latex, for rubber is now being transported in this form in increasing quantities in recent years. For this purpose the latex has to be concentrated. The concentrating of the latex, the preventing of discoloration, and the use of certain reagents for concentrating, are all matters under investigation. Incidentally, it is interesting to note that it has been found that different clones produce rubbers of different consistencies, some, for example, producing rubber of an abnormal softness.

It has only been possible to touch the fringe of the research work that is described in the annual report, but it is obvious that much work is being conducted on sound lines, which augurs well for the future of the industry. Plantation rubber will probably have to face competition from the artificial product in the future, for the effect of the War has been to stimulate research in the manufacture of rubber substitutes by synthetic methods, particularly in those countries which are unable to get natural rubber on account of blockade. It is satisfactory, therefore, to feel that those interested in the plantation industry, which is of such vital importance to Malaya and Ceylon, have taken steps to apply research methods with the object of raising the output per acre and reducing costs, and at the same time have realized the importance of regulating output so that the product may be made available to the whole world, when conditions again become normal, at a reasonable and stabilized price. By such methods the industry will be in the best position to meet any outside competition in the future.

SCIENTIFIC CENTENARIES IN 1941

BY ENGINEER CAPTAIN EDGAR C. SMITH, O.B.E., R.N.

AMONG the men of science whose centenaries occur this year, one stands out above all the others as a great reformer. This is Paracelsus, who died at Salzburg on September 24, 1541, four centuries ago. Born in Switzerland in 1493, he was a contemporary of Copernicus and Luther. In Dr. Seelig's "Medicine, an Historical Outline", Paracelsus is spoken of as "a man of extraordinary power, forceful character, untrammelled thought and ingenious medical instinct". His wanderings, his quarrels and his constant warring against dogma made him known throughout the universities of Europe, and interest in his activities has continued down to the present time. In NATURE of January 18, 1894, there was a note to the effect that the library of Dr. Schubert, of Frankfort-on-Main, contained no fewer than 194 editions of the works of Paracelsus, and 548 books dealing partly or chiefly with him. One of the latest lives of Paracelsus is that of Prof. J. M. Stillman, which was reviewed in these columns on August 12, 1922, by Sir Edward Thorpe.

Paracelsus lived at a time when the study of botany was attracting considerable attention. Medicine and botany went hand in hand, and this led to the foundation of botanic gardens. Those at Padua, Montpellier, Leyden and Leipzig were all founded in the sixteenth century, and that in Paris, now the Jardin des Plantes, in the early part of the seventeenth century. The inauguration of this garden was due to the French physician Gui de la Brosse, who died in 1641. He was a physician to Louis XIII. He bought a piece of land on which refuse had collected and there established in 1626 a Jardin Royal des Plantes Médicinales, of which he became the first superintendent. He collected plants from many parts of the world; in 1636 he made a catalogue of 2,000 specimens, and had upwards of 400 plates engraved. At his death these were disposed of to a brazier, but Fagon, the nephew of Brosse, was able to save about fifty of them from destruction. Nearly all Brosse's writings were about the garden and its plants.

The year 1641 also saw the death of Jeremiah Horrocks, the young Lancashire clergyman and astronomer, the first individual to witness a transit of the planet Venus.

Astronomy of the following century is represented by François de Plantade, of Montpellier, who died on August 25, 1741. With his countryman Clapies, Plantade observed the total eclipse of the sun of May 12, 1706, the first total eclipse of which the accounts, says Grant, have any pretensions to fullness or precision. That same year Plantade assisted in founding the Academy of Sciences at Montpellier. Born in 1670, he died suddenly at the age of seventy when climbing the Pic du Midi to carry out geodetical measurements.

Other men of science who died in 1741 were Ambrose Godfrey, who for many years assisted Boyle in his experiments; George Martine (1702–41), the St. Andrews physician, who in 1740 published an essay on the "Natural and Experimental History of the various degrees of Heat in Bodies", and the Danish navigator, Vitus Behring, who after serving in the navy of Peter the Great, spent several years exploring Siberia, its coasts and seas, and who perished on Behring Island on December 19, 1741.

The great explorers of the eighteenth century include also Jean François de Galaup, Comte de La Pérouse, who was born on August 22, 1741. After seeing active service in the Navy, he was given command, when forty-four years old, of an expedition to the coasts of the Pacific. In 1788 he sailed from Botany Bay, and no trace of him was found until 1826, when it was discovered that his ships had been wrecked on a coral-reef off Vanikoro, north of the New Hebrides. While La Pérouse was still serving in the French Navy, his fellow countryman Alexis-Marie Rochon (1741–1817), optician and astronomer to the Marine, was visiting many places in the Indian Ocean. With Leroy he was made keeper of a cabinet of nautical instruments at Brest. His attainments gained him a seat in 1795 in the newly founded National Institute, and when he died his place was taken by Fourier. Another well-known French man of science born in 1741 was the geologist Barthélemy Faujas de Saint-Fond (1741–1819). He held a chair in the Museum at Paris, and he was among the first to bring forward conclusive evidence of the igneous origin of basalt. His work "On the Extinct Volcanoes of Vivarais and Velay" was published in 1784. About this time he visited Great Britain and was hospitably entertained by Sir Joseph Banks and others. He attended a dinner of the Royal Society Club, of which he wrote, "Brandy, rum and some other strong liquors closed this philosophical banquet, which terminated at half-past seven, as there was to be a meeting of the Royal Society at eight o'clock. . . . I repaired to the Society along with

Sir Joseph Banks, Mr. Cavendish, Dr. Maskelyne, Mr. Aubert and Sir H. Englefield. We were all pretty much enlivened, but our gaiety was decorous." At Windsor, Faujas was startled to find Miss Caroline Herschel assisting her brother in recording observations.

Three Englishmen of note who were born in 1741 were Dr. William Withering, F.R.S. (1741–1799), physician, botanist and mineralogist, of Birmingham, friend of Watt, Priestley and Boulton; Joseph Huddart, F.R.S. (1741–1816), nautical surveyor and chart maker, who made a fortune out of his rope-making machine patented in 1799, and the Cornish clergyman and astronomer, the Rev. Malachy Hitchins (1741–1809). Though he began life as a miner, Hitchins was enabled through his wife to go to Oxford, and in 1767 Maskelyne found him a post at Greenwich Observatory as a computor. He made calculations for the "Nautical Almanac" from 1768 until his death at St. Hilary Vicarage, Cornwall, in 1809: "The reputation which the Nautical Almanac obtained was largely due to his care. . . ."

The names of men of science who died a century ago include those of the famous Swiss naturalist, Augustus Pyramus De Candolle, of Geneva, whose "two-fold enthusiasm was to increase the knowledge and advance the welfare of the human race", and the French entomologist, Jean Victor Audouin, a son-in-law of Alexandre Brongniart, the successor of Latreille at the Muséum d'histoire naturelle, a collaborator with Milne-Edwards and the first president of the French Entomological Society. Another French naturalist who died in 1841 was Jean François D'Aubuisson de Voisins (1769–1841), the geologist, who was the favourite pupil of Werner at Freiburg, but who abandoned Werner's views after he had visited the volcanic region of Auvergne. The same year saw the death of Felix Savart (1791–1841), the physicist who succeeded to Ampère's chair in the Collège de France; of the famous British surgeon, Sir Astley Paston Cooper, who is buried beneath the chapel of Guy's Hospital and whose statue is in St. Paul's Cathedral; of Dr. George Birkbeck (1776–1841), the pioneer of technical education, whose best-known memorial is Birkbeck College, London, and of the two mathematicians, Olinthus Gilbert Gregory (1774–1841) and George Green (1793–1841). Gregory, who was one of the projectors of the University of London, taught for many years at the Royal Military Academy, Woolwich, and was known both as a writer of text-books and as experimenter, while Green is remembered principally for his "Essay on the Application of Mathematical Analysis to the Theories of Electricity and Magnetism", in which he first applied the term "potential" to these branches of science. Green was largely self-taught, and he did not study at Cambridge until he was forty years of age, five years after his essay was published. He was only forty-seven when he died.

Of the many men of science born in 1841, one of the most eminent was the French physicist Marie-Alfred Cornu, For. Mem. R.S. (1841–1902), for many years professor of physics at the École Polytechnique, and in 1896 president of the Paris Academy of Sciences. After his death in 1902, Silvanus Thompson wrote of him in NATURE as a man who had won universal esteem: "A true follower of the great traditions of France in the pursuit of science and a passionate follower of Arago, Biot, Fresnel and Fizeau, he was in his own person much more than this. He was the ideal of a well-equipped well-balanced intellectual leader in scientific thought."

Science in Italy last century is represented in the records by Antonio Pacinotti (1841–1912), who, as a youth serving in the Garibaldean Wars, pondered over the construction of his ring armature dynamo, for the invention of which he is remembered, while science in Switzerland is represented by the Lausanne anatomist and physiologist, François Alphonse Forel (1841–1912), who made a life-long study of the Lake of Geneva, and whom Chrystal called "the Faraday of Seiches".

Centenaries of astronomers of note, professional or amateur, are numerous, for 1841 saw the birth of Herman Vogel (1841–1907), director of the astrophysical laboratory at Potsdam; of Friedrich Engelmann (1841–88), of Leipzig, who published Bessel's collected works; of Theodor von Oppolzer (1841–86), of Vienna; and of Hugo Gylden (1841–96) of Stockholm, both known especially as eminent teachers. Three British astronomers born in the same year are Andrew Ainslie Common (1841–1903), an engineer who became known for his construction of silver-on-glass mirrors; W. E. Crossley (1841–1905), a carpet manufacturer, who at Halifax installed a telescope having one of Common's mirrors which he afterwards gave to the Lick Observatory; and G. F. Chambers (1841–1915), a lawyer, who was the author of an excellent "Handbook of Descriptive Astronomy" which passed through several editions.

To complete this survey, brief mention may be made of several workers in other fields of science. Karl August Lossen (1841–93), a member of the Prussian Geological Survey, was spoken of as the founder of dynamic metamorphism; Edouard François Dupont (1841–1911), another geologist, was the honorary director of the Royal Museum of Natural History at Brussels, and William Topley, F.R.S. (1841–94), who did notable work on the Geological Survey of Great Britain and

served as president of the Geologists' Association. Topley began his work on the Survey with Clement le Neve Foster, F.R.S. (1841–1904), who had studied at Freiburg, and in 1890 succeeded Sir Warington Smyth as professor of mining at the Royal School of Mines. In 1903 Foster was knighted. The Irish chemist, Cornelius O'Sullivan (1841–1907), and the English chemist, Walter Flight (1841–85), both owed much to their contact with Hofmann, to whom they became assistants after his return to Berlin. Both were fellows of the Royal Society, but while O'Sullivan's researches were connected with the chemistry of brewing, Flight's investigations led him to the study of the mineralogical constitution of meteorites, his work being done in a laboratory at the British Museum, where he held a post. Of the engineers born in 1841, John Donaldson (1841–99) and George Wallace Melville (1841–1912) were connected with marine engineering. Donaldson was a pupil under Rankine at Glasgow; in 1872 he joined Sir John Thornycroft at Chiswick, and was associated with the development of high-speed torpedo boats and torpedo-boat destroyers. Melville held the high office of engineer-in-chief of the United States Navy for sixteen years, during which period the American fleet grew from an almost negligible force to one of the most powerful.

OBITUARIES

Dr. J. W. Blagden

DR. J. W. BLAGDEN died on November 28 at his home in Loughton, Essex, in his sixty-seventh year. He came from a scientific family, and was educated at Dulwich and Emmanuel College, and took an honours degree in natural science in 1895. Proceeding to Würzburg, he worked under Häntzsch, obtained his Ph.D., and after a period as senior demonstrator in electro-chemistry at Darmstadt, entered industry with C. F. Böhringer und Söhne as research chemist and departmental manager. He worked on electrolytic oxidations and reductions, and later became interested in the then new field of catalytic hydrogenations. In this, particularly in its applications to industry, he was one of the pioneer workers. The outbreak of war in 1914 put an end to his work in Germany. During the period of hostilities he was an internee at Ruhleben, where as the leader of a group he endeavoured to continue scientific work, an effort typical of a man who refused to be dismayed by difficulties. At the end of the war he returned to England and sought an opportunity to continue his work on catalysts. He joined Messrs. Howards and Sons, Ltd., in 1919 and undertook the organization and direction of a newly formed Research Department. The range of new products manufactured by the firm during the last twenty years is a tribute to the energy and skill with which he pursued the task. In 1929 he was elected a director of the Company.

Blagden was a fellow of the Institute of Chemistry and the Chemical Society, and a member of the Society of Chemical Industry. He served on a number of Committees, among which may be mentioned the Pharmacopœia Commission, the Essential Oils Committee of the Imperial Institute, Chemical Committees of the British Standards Institution and the Patents Committee of the Association of British Chemical Manufacturers.

He had little desire or time for publication, and apart from a few relatively minor papers the record of his work exists in patents and in the technical achievements of the laboratory under his direction.

Dr. Blagden was always accessible to members of his staff, and devoted much of his time to their encouragement and welfare. He felt that industry owed a debt to the universities, and was pleased to acknowledge this by both material and technical assistance whenever possible.

Dr. C. W. Saleeby

DR. C. W. SALEEBY, who died on December 9, aged sixty-six, was a popular lecturer and writer, able to put forward the views he furthered in simple direct language illuminated by apt and telling phrases. He was in particular an exponent of eugenics, in my opinion a lost cause, for the British people cannot be persuaded, and are not stimulated by family allowances by Government, to have enough children to maintain the vigour of the nation after the War. There is great doubt, too, whether eugenics, except in the case of a few rare inherited disabilities, is of any value.

A far more valuable field of Saleeby's propaganda was that of sunlight and open air as givers and restorers of health. He founded the Sunlight League, and its continuance depended mainly upon him. In the *Journal* of this League were well advocated the views he held so strongly. His own dwelling in London was contrived to secure all the benefit possible from sunlight. In his lectures he made much of Rollier's great successes in treatment of tuberculosis at the Leysin Sanatoria and the open air school run there as a prevention of disease for delicate children. In doing so Saleeby did not seem to be aware of the pioneer work of that great surgeon Oscar Bernhard at St. Moritz, who inspired the work of Rollier and whose surgical methods of wound treatment by sun and open air are of great value to-day. With the death of Saleeby an enthusiastic popular teacher has passed away.

LEONARD HILL.

NEWS AND VIEWS

President Roosevelt and United Democracy

IN his 'fireside talk' on December 29, President Roosevelt reached the highest point he has yet attained in his career as statesman and a great leader of democracy. No less than the successes of allied arms in the field, it holds out a promise of ultimate victory and marks a substantial stage in progress towards a 'new order' of democratic unity. As he had elected national security rather than war as his topic, his statement was addressed primarily to the people of the United States; but in order that he should place the situation as it affects their country fairly and squarely before them, he was bound by the logic of present realities to show how the forces of aggression embodied in the Axis Powers form a threat to the Americas as a whole, and in aiming at a world domination were bent upon the destruction everywhere of that freedom which is of the essence of democracy. By the cogent argument of the facts of recent history in the action of "a gang of outlaws" against weaker neighbouring peoples, and the inevitable consequences which would follow their success in Europe, he showed that American civilization and American independence "had never before, since Jamestown and Plymouth Rock," been in such danger.

"The Nazis," Mr. Roosevelt went on to point out, "can never reconcile themselves to a democratic world. The Axis proclaims there can be no ultimate peace between their philosophy and ours." The grave warning addressed to the people of Eire indicated that, in the opinion of the President, no less than of others more intimately involved, no reliance is to be placed upon the protection of a neutrality such as that on which Eire takes its stand. To the threat to the Americas the armed forces of Great Britain and those soldiers of its allies who have escaped alone oppose a barrier. Hence it behoves America, in President Roosevelt's words, to become the arsenal of the democracies, and to spare no effort, short of an expeditionary force, to support them. So from the President's exhortation to the American people there emerges a pattern—it might almost seem a prophecy—of a world in which stand united all peoples who hold fast to the democratic ideal, with Great Britain and the United States in the forefront. They stand, and will continue to stand, united in defence of those ideals, freedom, justice and tolerance, everywhere and at all times against aggression and exploitation.

The Fire of London

ON December 29, after four months of vicious, though unsuccessful, attempts to destroy the spirit of London, the Nazis attempted to destroy her heart by fire from the air. Those of us who experienced the wanton assault need no further proof that it was a deliberate attempt to fire one of the most vulnerable points in the world, although no targets of military value were attacked. It may be that the attack was not necessarily one of desperation (as suggested in some quarters), but rather an integral part of the Nazi war effort to destroy anything symbolical of the democratic ideal and tradition. If so, then it has proved a dismal failure; London has withstood its ordeal by fire. It is true that some irreparable material damage has been done. Guildhall is a blackened shell; eight Wren churches have been wrecked; the Central Criminal Court has been damaged; the house in Gough Square, Fleet Street, where Dr. Johnson compiled his dictionary has been burnt out; Goldsmiths' College, which is incorporated in the University of London, was destroyed; and so on. The night was awesome—a clear demonstration of the senseless ferocity of aerial warfare as conceived by the Nazis.

But St. Paul's Cathedral, symbol of the faith of many Britons, stood out as a challenge and an inspiration. It has withstood previous attacks, though that of Sunday, December 29 must inevitably rank high among the many barbarous, though futile, attempts by the German High Command to crush the armies of freedom. History is being writ large; but more important at present is it that here we have further proof, if such is needed, that we are fighting, and must overcome, evil things. Nobody but another Nazi could support such 'strategy', which is eloquent of the very philosophy of totalitarianism, emphasizing as it does, among other things, the total destruction of all that democracy stands for, material and moral. Lovers of freedom, whether in the fighting services, defence services, office, field, library or laboratory, must collaborate wholeheartedly and give of their best, and thus become effective defenders of freedom.

British Museum (Natural History): Air Raid Damage

A NUMBER of bombs, both high explosive and incendiary, have fallen on the Museum premises, and serious fires have occurred in the General Herbarium and the Shell Gallery. Considerable damage was done to the botanical collections, but it will be impossible for some time to arrive at any final conclusion as to the extent of this, since so much depends on the degree of success achieved in the work of salvage and reparation which is still in progress. The greater part of the damage was done by water, and time alone can show how far this is irreparable.

The Shell Gallery was fortunately almost empty when the fire took place, and the damage to the collections was inconsiderable, though the roof of the Gallery was destroyed and a number of show cases were ruined. Some damage has been done by water in other parts of the Museum, but this is believed to be not very great. A vast number of windows and skylights have been broken, and there has been minor damage to the structure and to furniture in various parts of the building. The fossil tree which stood in the Museum grounds has been knocked down and broken but is capable of being repaired and re-erected.

Moss in War-time Medical Dressings

THE position in the War of 1914–18, when the acute shortage of cotton-wool necessitated the widespread use of Sphagnum moss as an absorbent dressing for field wounds, has been anticipated in the present efforts to recommend reserves of this material properly collected and suitably prepared (*Lancet*, Dec. 14, p. 753). During 1914–18, when the War Office officially sanctioned the use of bog-moss and itself ordered considerable supplies from Dublin and Edinburgh War Dressings Supply Centres, Colonel C. W. Cathcart, of the Edinburgh Royal Infirmary, investigated its properties in comparison with other cheap and easily available absorbants and deodorants like pinewood sawdust and peat moss litter and showed its considerable advantage, even over ordinary cotton-wool (*Brit. Med. J.*, July 24, 1915).

The history of Sphagnum as a wound dressing is, however, older than the War of 1914–18. The earliest record is given in Joyce's "History of Ireland", when it was described as used for a wound dressing on the battlefield in the battle of Clonturf in 1014. The first use in medical science was at Kiel, in Germany, last century, when a workman who had lacerated his forearm had it wrapped in peat moss, and he was sent down to Kiel, where he arrived ten days later, and, to the surprise of the medical authorities on removing the moss, the wound had healed most satisfactorily (Neuber: "Erfahrungen über Iodoform under Torf-Verbande", *Arch. klin.-Chir.*, **27**, 757; 1882). The first recommendation for its use by the British during the War of 1914-18 was apparently Prof. J. Bailey Balfour's letter to the *Scotsman* of November 17, 1914, although the pioneer work in medical circles was that of Col. Cathcart. The Canadians and Americans in the later stages of the War were preparing considerable supplies of these dressings for their own troops in the field. In 1916 the Irish material prepared at Dublin reached an output of 20,000 dressings a month, 5,000 of which went to the War Office and the rest to eighty hospitals. The Edinburgh station was supplying 2,000 dressings a week for military use without charge.

British Drug Plants

THE wholesale cultivation of drug-producing plants in Great Britain is being encouraged by the Pharmaceutical Society and the Ministry of Agriculture to meet the deficiency of Continental imports, and a medical correspondent in the *Lancet* of December 7 points out the dangerous position arising from the prohibitively high prices and the acute shortage of necessary drugs. A survey by the *Chemist and Druggist* of the present conditions on the nine big commercial drug-plant farms in Great Britain reports a fairly good harvest this past season, but considerable extensions will be required to meet the needs of the manufacturing chemists in 1941. The chief plants required, and suitable for wholesale cultivation as field crops, are deadly nightshade (*Atropa belladonna*), thorn-apple (*Datura stramonium*), henbane (*Hyoscyamus niger*), monkshood (*Aconitum napellus*), foxglove (*Digitalis purpurea*), hemlock (*Conium maculatum*), white horehound (*Marrubium vulgare*), skull-cap (*Scutellaria galericulata*), male fern (*Lastrea Filix-mas*), mother-wort (*Leonurus cardiaca*), chamomile (*Anthemis tinctoria*), wormwood (*Artemisia absinthemum*), squirting cucumber (*Ecballium elaterium*), opium poppy (*Papaver somniferum*), and valerian (*Valeriana officinalis*).

Fortunately, the Ministry of Agriculture's handbook on the subject is an up-to-date work with the experience of the War of 1914–18; but, in addition to cultivating the herb crops, accurate methods of early harvesting and early and slow drying are necessary if the full chemical resources of the plants are to be available. It may also be necessary to cultivate herbs of the Labiates, like lavender (*Lavendula vera*), rosemary (*Rosmarinus officinalis*) and wound-wort (*Stachys betonica*), and some Umbellifers, like angelica (*Angelica archangelica*), for their essential oils for the perfumery and essential oil trade. Although the position regarding organic dyes is much better than in the War of 1914–18, the return to cultivation of woad (*Isatis tinctoria*) and other dye-producing plants is envisaged.

Palæolithic Paintings in the Dordogne

IN the enthusiasm of fresh discovery, archæologists at times are apt to overstress the importance of their finds. No reservation is necessary in appreciating the outstanding character of the remarkable discovery of the cave and paintings of palæolithic age at Lescaux in the Dordogne valley, recorded by the Abbé Breuil in another column of this issue of NATURE (see p. 11). Although at the time of writing examination of the cave had proceeded no further than would warrant a preliminary report, sufficient of its nature had already been revealed to justify the conclusion in the opinion of the Abbé Breuil that the discovery is of exceptional importance. To quote his own words "as . . . Déchelette called Altamira 'the Sixtine Chapel of Magdalenian art', so Lescaux represents with equal splendour that of the far more ancient Perigordian". In this remarkable cave with its high central hall and galleries, the latter for the most part still unexplored, are more than eighty paintings, chiefly on blocks fallen from the roof, as well as engravings—in the hall superposed upon the paintings, in the galleries unaccompanied—which it has not yet been possible to examine adequately on account of their delicacy.

In the paintings, the Abbé Breuil distinguishes according to character and technique nine divisions or classes, each depicting characteristically animals or parts of animals, as well as rectangles, comb-shaped signs and other conventional forms. Reindeer and mammoth notably are absent, while "more unusual" is a composition in which black rhinoceros, bison, and a recumbent human form appear—possibly "a prehistoric drama", and if so a valuable piece of evidence bearing upon the nature of palæolithic belief and ritual. From this evidence the Abbé Breuil draws certain tentative conclusions as regards the age of the engravings and paintings. The stags and oxen show a truly remarkable and unique

similarity with those of the eastern Spanish palæolithic art, where also is found a twisted perspective in depicting horns of stags and oxen, which appears at Lescaux. From this and other comparisons, the important inference is drawn that the paintings of Lescaux are earlier than both Magdalenian and Solutrean, but later than typical Aurignacian. They represent the phase of Upper Palæolithic culture, but recently differentiated and known as "Perigordian".

Prof. Ernest O. Lawrence: Duddell Medallist

THE formal presentation of the seventeenth Duddell Medal of the Physical Society to Prof. E. O. Lawrence, the award of which was announced in NATURE of June 1, p. 852, was made at a dinner of the American Physical Society in Philadelphia on December 27 by Mr. Neville Butler, First Counsellor to the British Embassy and H.M. Chargé d'Affaires *ad interim* in Washington—it had been the late Lord Lothian's intention to present the medal. At a luncheon held by the Physical Society in London on the same day, an interesting word picture of Prof. Lawrence was given by his friend and former pupil, Dr. W. B. Mann. Dr. Mann first referred briefly to the development of the Berkeley cyclotrons, from the 4-inch instrument in 1930 (when Lawrence, at the age of twenty-nine, had recently been appointed professor of physics in the University of California), to the 37-inch (85-ton) and 60-inch (220-ton) cyclotrons and the projected giant cyclotron of some 4,900 tons. He then described the team work of the Radiation laboratory at Berkeley and recalled many incidents to show the outstanding qualities of its distinguished chief—his deep, innate *sense* of physics, his skill in finding the causes of breakdowns, his large share in making the subsequent readjustments until perfect running was again effected, his boisterous and irrepressible enthusiasm away from work (such as on a ski-trip or in his motor-cruiser on San Francisco Bay), and his complete selflessness. Prof. Birge had quoted Lawrence's first remark on being informed of the award to him of the Nobel Prize for Physics in 1939: "It goes without saying that it is the laboratory that is honoured, and I share the honours with my co-workers past and present." Again, the closing words of Lawrence's response at the presentation of that Prize were: "May I again give expression to a profound feeling of gratitude and appreciation for this great honour, which I share with the university and with all those outside who have contributed to make our work possible and, above all, with my valued colleagues and co-workers both past and present." An article based upon Dr. Mann's address appears in the January issue of the *Proceedings of the Physical Society*.

PROF. E. O. LAWRENCE.

New Cyclotron at Berkeley, California

GOOD progress is being made, according to news received recently from the United States, in the erection of the 194-inch cyclotron at Berkeley, California. The cost of this apparatus, it will be recalled (NATURE, May 18, 1940, p. 776), will be more than £200,000, and is being provided by the Rockefeller Institute. The concrete bed for the steel magnet, containing 1,200 tons of concrete, is finished. The erection of the steelwork is now starting, and is expected to be completed by April next. This will contain 3,700 tons of steel, the overall dimensions being, length 56 feet, width 184 inches, height 30 feet. The upper and lower yokes are to be built of some 36 sheets each of steel, 2 inches thick and 56 feet long, bolted and ultimately to be welded together to withstand earthquake shock. 300 tons of copper in the form of strip, 4 inches wide and $\frac{1}{4}$ inch thick, will be required for the windings. The cyclotron is expected to yield one hundred million electron-volt deuterons in a field of 10 kilogauss, for which the resonance wave-length is 39 metres.

Physiology at Cambridge: Mr. W. Freeman

AT a meeting of the Physiological Society held in Cambridge on December 18, a presentation was made by physiologists trained in the Cambridge school to Mr. William Freeman, the senior laboratory assistant. Mr. Freeman, known to many generations of students as 'John', completed his fiftieth year in the laboratory last October. As biological technician he was closely associated with Langley and Anderson in their work on the autonomic system, but during the past fifty years he has aided no less than four of the secretaries of the Royal Society (Michael Foster, Sir William Hardy, Sir Henry Dale and Prof. A. V. Hill) and three of its presidents (Sir Charles Sherrington, Sir Frederick Gowland Hopkins and Sir Henry Dale). The presentation was made by Sir Henry Dale after congratulatory speeches by Prof. E. D. Adrian and Dr. L. E. Shore.

Tercentenary of Jeremiah Horrocks

ON January 3 occurred the tercentenary of the death of the young Lancashire curate Jeremiah Horrocks, whom Herschel spoke of as the pride and boast of British astronomy. In the fourteenth year of the reign of Charles I, and some twenty years before the foundation of the Royal Society, in the hamlet of Toxteth Park near Liverpool and in the village of Hoole, eight miles south of Preston, Horrocks, with the aid of the tables of Lansberg and the works of Kepler, recalculated the transit of Venus and, on Sunday afternoon, November 24, 1639, in between his church services at Hoole, had the great satisfaction of watching the passage of the planet across the sun's disk. His friend, William Crabtree, also observed the transit from near Manchester, but Horrocks's brother Jonas, at Liverpool, failed to see it owing to clouds. Within fourteen months of his achievement, Horrocks had passed away, being then but twenty-two or twenty-four years of age. He had, however completed his "Venus in Sole Visa".

Though he made his observations at Hoole, Horrocks passed most of his life at Toxteth Park, save for the three years 1632–35, which he spent as an undergraduate at Emmanuel College, Cambridge. The site of the house he was born in is now covered by the Otterspool Railway Station; his grave is in the grounds of the ancient chapel of Toxteth, a place of worship associated with the early Dissenters. Not far away is the Church of St. Michael's, and here in 1826, the Lancashire gardener-weaver-astronomer Moses Holden (1777–1864) erected the first memorial to Horrocks. In 1859 the Rev. A. B. Whatton published a translation of his "Venus in Sole Visa", together with a memoir of Horrocks; a memorial chapel and window were added in the same year to Hoole church, and when attention was again being directed to Horrocks's work by the transit of Venus of 1874, steps were taken to place a memorial in Westminster Abbey.

On November 12, 1874, NATURE recorded the permission given for the erection of this memorial, and a list of subscribers, headed by the names of Adams and Airy and including those of Christie, De la Rue, Lassell, Lockyer, Proctor, and "the Village of Hoole". The memorial in the Abbey, unveiled in 1879, consists of a scroll placed within the monument to John Conduitt, the nephew of Newton, at the west end of the nave. Owing to Horrocks's premature death, and the confusion of the times, some of Horrocks's manuscripts were lost. That of the "Venus in Sole Visa" was saved, and a copy passed to Huygens and then to Hevelius, who published it in 1662. Other manuscripts were published by John Wallis in 1673, and these showed that Horrocks had views on many subjects far in advance of his time. In Manchester Town Hall there is a fresco by Madox Brown recalling the observation of the transit of 1639, but in this the scene is Manchester and the central figure is Crabtree.

Psychology of Joan of Arc

IN a paper entitled "A Medico-psychological Revision of the Story of Jehanne La Pucelle" read before the Section of the History of Medicine of the Royal Society of Medicine on December 4, Dr. H. P. Bayon said that modern historians, by interpreting medieval religious conceptions according to the dictates of contemporary critical doctrines, have failed to examine the voices and visions of La Pucelle in their proper light and sequence. The first voices heard at the age of thirteen were, according to him, connected with endocrine activity tinged by intense religious fervour and could not be rightly diagnosed as morbid, even if they ranked as somewhat abnormal. A couple of years after, the simple monitions of the voices were followed by visions and commands, directing the Maid to perform valiant military deeds for a patriotic service; these must be classified as something additional, since their purpose was creative and constructive and furthered the accomplishment of a certain preconceived plan by providing confidence in her mission and obtaining authority for her message. Joan of Arc thus became instinctively the first protagonist of that form of national patriotism which was to play such a part in arranging States and dynasties in Europe during succeeding centuries.

Her courage and perseverance could be matched by other heroines in history; the boldness of her patriotic conceptions was unique, not only for her age and sex, but also because of her youth and lack of military education. In constructive leadership she far surpassed Christine de Pisan, who had full opportunities for obtaining the knowledge requisite in formulating the teachings of French nationalism. Even if her voices and visions were diagnosed as hallucinations, there was no reason to consider these as part of a system of morbid delusions. Not only their form and content but also her subsequent behaviour provided full evidence that she conceived, planned, and put into execution a programme of national survival which obtained historical significance. Such achievements could not be the outcome of the wild vapourings of insanity; they must be the work of creative genius.

Chemistry at St. Andrews

SIR JAMES IRVINE, principal and formerly professor of chemistry of the University of St. Andrews, reviewed the history of chemical teaching at the University in an address on December 6 before the University of St. Andrews Chemical Society. The story goes back, Sir James said, to 1808, when the University accepted a gift of £1,500 from Dr. John Gray, of Paddington, to institute and maintain a chair of chemistry at St. Andrews. This sum was totally inadequate to found the chair, and no appointment was actually made until 1840. While Sir David Brewster was principal of the University, the endowment was brought up to £2,700, and Dr. Arthur Connell was appointed the first professor of chemistry. Connell, who became an authority on mineral analysis, was succeeded in 1862 by Prof. Matthew Forster Heddle. Heddle devoted his attention chiefly to mineralogy; among his students were James Stuart, afterwards the first professor of engineering at Cambridge, Francis Robert Japp, who became professor

of chemistry at Aberdeen, William J. Matheson, an American who founded an entrance scholarship and a bursary for chemistry at St. Andrews, and Thomas Purdie, who was to succeed Heddle in the professorship.

Purdie's occupancy of the chair marked a turning point in the history of chemistry and in the history of the University of St. Andrews. In his inaugural address, he stressed the "high educational value" of research; he introduced the study of organic chemistry, and he succeeded in establishing a research laboratory, the first of its kind in Scotland. An uncle of Purdie's left him a large sum of money, which he used to build a laboratory, and he had the satisfaction of seeing his research school well established. Purdie was succeeded in 1909 by Sir James Irvine himself, who continued in the chair until 1920, when he became principal of the University. The next occupant was Sir Robert Robinson, who was followed in 1922 by Prof. John Read. Summing up, Sir James pointed out that the St. Andrews chair of chemistry had had six occupants, five of whom, including the present holder, were fellows of the Royal Society; it had trained sixteen professors and one Government chemist. Altogether, this is a notable record for a chair which has been functioning for just a hundred years.

Health Conditions in Guatemala

IN a recent message to the National Legislative Assembly, General Jorge Ubico, the president of Guatemala, gives the following details concerning health conditions in that country during 1939. 324,031 treatments were given to 67,371 malaria patients, 85,407 persons were treated for intestinal parasites, 2,486 dysentery cases received 13,123 treatments, 4,073 onchocerciasis patients were treated, 64,640 treatments for venereal disease were administered and 250 women were given 7,725 examinations. There were mild epidemics of whooping cough, diphtheria, measles and typhoid fever. The country has seventeen departmental hospitals, which cared for 48,815 persons.

Recent Earthquakes

ON December 20, at about 2.30 a.m. local time, an earthquake shook a wide area in the north-eastern United States and south-eastern Canada. It is reported to have been felt by people for some forty-five seconds in parts of Massachusetts, Maine, Connecticut and Rhode Island, and for a shorter time and less severe in Long Island, New York and New Jersey. In Montreal thousands of residents were awakened by the rattling of loose objects such as crockery on shelves, but no damage or casualties are reported. Another shock affected the same area on the morning of December 24, but only minor damage was caused and no casualties are reported. It is anticipated that the United States Coast and Geodetic Survey and other seismologists in the United States and Canada will be examining both instrumental and macroseismic evidence of the shocks, and any report is awaited with interest.

Also on December 20 an earth tremor was reported to have been felt for several seconds in the lower valley of the Arno River near Florence in Italy. Two earthquake shocks rocked the Erzinjan district of Turkey in the early hours of December 25, according to a message from Ankara. No damage or casualties are reported. The great Turkish earthquake in the same district occurred at 1.57 a.m. local time on December 27, 1939 (NATURE, January 6, 1940).

Comet Cunningham

A SHORT notice about this comet was published in NATURE of November 2 (p. 587). More recent observations have enabled Mr. Cunningham to compute a better orbit, the elements of which are given below:

T	.. ..	1941 Jan	16.25204	
ω	.. ..	199°	35·5′	} 1940·0
Ω	.. ..	295	42·2	
i	.. ..	49	51·8	
q	.. ..	0·36822		

An ephemeris is given, commencing January 2. The comet is moving rapidly southwards, and after January 10 it will be too close to the sun to be observable. On January 6 it will be near α Aquilæ and should be easily visible to the naked eye.

	R.A.	Dec.	ϱ	r
Jan. 2	19h. 35·3m.	+5° 54′	0·67	0·54
„ 6	„ 34·3	−2 19	0·62	0·47
„ 10	„ 31·5	12 58	0·59	0·41

Announcements

M. HENRI BERGSON, the celebrated philosopher, has refused to be exempted from the clauses of the new statute relating to Jews in France. The exemption was offered him for "exceptional services rendered to literature, science and art". He will therefore have to resign his chair at the Collège de France.

PROF. ROBERT D. DEFRIES has been appointed director of the School of Hygiene and of the Connaught Laboratories, University of Toronto. During the past twenty-five years he has been prominent in the work of these two institutes, having early in 1915 become actively associated with the late Prof. J. G. FitzGerald, whom he now succeeds.

IN Administrative Memorandum No. 255 the Board of Education refers to the considerable risk of fire due to breaking of bottles containing dangerous chemicals in the event of a school being bombed. Those responsible should take precautions to minimize the risk. Only the smallest quantities of those chemicals, in particular, sodium, potassium, phosphorus, ether and strong acids, should be kept in the building and they should be stored in metal containers.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. They cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

IN THE PRESENT CIRCUMSTANCES, PROOFS OF "LETTERS" WILL NOT BE SUBMITTED TO CORRESPONDENTS OUTSIDE GREAT BRITAIN.

Stationary Electric and Magnetic Fields in Beams of Light

ACCORDING to the electromagnetic theory of light (Maxwell, Hertz) the electric light vector and the magnetic light vector oscillate perpendicularly to the direction of propagation. The energy of the wave is given by Poynting's vector.

It is shown below, on the basis of experimental findings, that every wave of light possesses likewise a stationary field intensity E in its direction of propagation and also the stationary magnetic field of intensity H. That means there is a potential difference between two points on the ray of light. Accordingly, it should be possible to collect electricity from the ray under suitable conditions. A beam of light therefore constitutes a source of electricity; furthermore, light has magnetizing effects.

Experimental proof of this generalization was obtained from my investigations of the interaction between light and small particles of matter[1]. This permits of the measurement of forces of the order of 10^{-9} to 10^{-10} dynes. The sensitivity of measurements of forces is thus increased by my methods by a factor of 1,000–10,000.

When particles of matter are irradiated by sufficiently intense light of sufficiently small wave-length, regardless of the direction of the wave front normal, then positive or negative electric charges, or north or south magnetic poles, are induced on these particles. Particles of otherwise identical properties move in a homogeneous electric or in a homogeneous magnetic field in or against the direction of the electric field (electro-photophoresis), or in or against the direction of the magnetic field (magneto-photophoresis). These induced temporary electric or magnetic ions exist as long as the particles are irradiated by sufficiently intense light. Furthermore, it can be observed that some particles stay at rest and that their motion commences suddenly, or that moving particles appear to change their velocity and even reverse it. These are due to changes of charge. The movement of magnetic ions in a homogeneous magnetic field is a 'magnetic current'.

These phenomena are best observed when *two* fully symmetrical beams of light are directed against each other and when the fields act perpendicularly, are reversible and free from residual magnetism and electricity, and are also homogeneous. The intensity of this motion depends upon the frequency of the light wave. It increases with increasing frequency and is also dependent on the material. I have also found that, when using just *one* concentrated beam of light, without any field, small particles of matter of magnitude 10^{-4} to 10^{-5} cm. of the same kind as before moved in clean gases either away from the source of light (light-positive, longitudinal photophoresis) or towards the source of light (light-negative, longitudinal photophoresis). This force increases with the intensity of the light and likewise depends upon frequency and material.

There are particles which do not show longitudinal photophoresis at first, but only after a certain time, and some which gradually lose it. I have shown in another paper also that radiometer forces cannot account for these effects[2]. Longitudinal photophoresis has also been found in liquids with particles of the same material. These particles moved in opposite directions (Satiendranat Ray, Lucknow; W. Barkas, London).

Since light makes particles of matter unipolar with respect to homogeneous electric fields, and since, when no such fields act, it makes them move in or against the direction of its wave front normal, there must be an electric field E coincident with the direction of the wave front normal. This means that electromagnetic waves possess longitudinal stationary components of E, and therefore potential differences between different points along the beam. The magnitude of those fields can be calculated from actual measurements.

These facts have been confirmed by further experiments by myself and by some of my pupils. An electric field suitably arranged *parallel* to the wave front normal permits the acceleration or retardation or even reversal of positive or negative photophoresis. The superposed field alters the component of the electromotive force in the direction of the beam.

From similar experiments it can be concluded that stationary magnetic fields exist in the beam of light, since superposed magnetic fields accelerate or retard the magneto-photophoresis. Those stationary magnetic fields in the beam of light have a magnetizing effect on the material as above mentioned.

In conclusion, I find that light beams have electric stationary components in the direction of the wave front normal, and that consequently there must be stationary electric potential differences between different points along the beam. There must also be a stationary magnetic field in the beam of light with potential differences.

FELIX EHRENHAFT.

New York City,
Nov. 28.

[1] *Ann. Phys.*, **13**, 151 (1940).
[2] *J. Franklin Inst.*, **230**, 381 (1940).

The ε-Galactan of Larch Wood

THE occurrence of this material, which is of considerable interest in connexion with the chemistry of wood formation, has been recognized for some time and it has been shown to contain *d*-galactose and *l*-arabinose residues[1]. In a recent article[2] descriptions are given of esters of this galactan and of its methyl ether, and the authors tentatively conclude that the substance hitherto designated ε-galactan is probably a mixture of a galactan and an araban. As the outcome of experiments carried out before the outbreak of war we had reached a similar conclusion, arrived at from a study of the hydrolysis products obtained

from methylated ε-galactan. In view of the fact that Wise *et al.* have not dealt with the hydrolysis of the methyl derivative, we are now summarizing the main features of our results, which, although incomplete, had already given information concerning the structure of this galactan.

The arabinose residues, as shown by their rate of hydrolysis to free arabinose, possess the furanose structure which has been found also in all the naturally occurring arabans hitherto examined[3]. The galactan portion undergoes no appreciable change when subjected to the mild acid conditions which suffice to hydrolyse the araban. This is to be expected since (see below) all the galactose is present in the pyranose form. Furthermore, arabinose-free galactan thus obtained gives a fully methylated derivative $[\alpha]_D - 18°$ in methyl alcohol which is identical with the substance obtained by separation of the methylated galactan from the mixture of methylated galactan and methylated araban produced by methylation of the original ε-galactan. These observations provide strong evidence that the original ε-galactan was a mixture of polysaccharides and that the arabinose residues are not attached to galactose.

On hydrolysis the methylated galactan gave rise to the following products: (1) 2 : 3 : 4 : 6-tetramethyl galactopyranose (1 mol. proportion), (2) 2 : 4-dimethyl galactopyranose (1 mol. proportion), (3) trimethyl galactopyranose (1 mol. proportion). This consisted mainly (perhaps entirely) of 2 : 3 : 4-trimethyl galactopyranose, but with the evidence at present available it is just possible that another trimethyl galactose (2 : 4 : 6 ?) might also be present. (4) A methylated uronic acid is present in very small amount.

These results establish the general type of structure present in the galactan. The three galactose residues which comprise the repeating unit of the galactan molecule are respectively: (1) a terminal galactose residue attached only through C_1; (2) a residue attached to the others through C_1, C_3 and C_4; and (3) a residue attached through C_1 and C_6 (with the possibility, referred to above, that in some residues the junctions may be through C_1 and C_2, depending on whether the presence (in the products of hydrolysis) of 2 : 4 : 6-trimethyl galactose is or is not established). The problem is formally similar to that discussed in papers on the arabans[3]; and as a particular example of the general type to which the structure must conform the following may be cited, in which a chain of β-linked galactose residues has another residue attached laterally as a side chain (Ga = galactopyranose residue):

$$\ldots\left[\begin{array}{l}.6\ \text{Ga}\ 1,\ 6\ \text{Ga}\ 1. \\ 3 \\ 1 \\ \text{Ga}\end{array}\right]_n\ldots\ldots$$

There are obvious variations of this, between which no decision can yet be made. It is not possible to give a definite estimate of the chain-length of the molecule, although it may be mentioned that from viscosity data a molecular weight of about 2,300 has been suggested[4], and the significance of the uronic acid residue present in small amount is not yet apparent. This type of structure is similar to that present in plant gums and reveals a striking general resemblance between this galactan and the araban of pectic materials, although the ring structures of the constituent sugars differ completely and there is no possibility that such an araban could arise by oxidation and decarboxylation of this galactan.

E. L. HIRST.
The University, J. K. N. JONES.
Bristol.

W. G. CAMPBELL.
Forest Products Research Laboratory,
Princes Risborough.
Nov. 29.

[1] Wise and Peterson, *Ind. Eng. Chem.*, **22**, 362 (1930).
[2] Peterson, Barry, Unkauf, and Wise, *J. Amer. Chem. Soc.*, **62**, 2361 (1940).
[3] Hirst and Jones, *J. Chem. Soc.*, 502 (1938); 453, 1865 (1939).
[4] Owens, *J. Amer. Chem. Soc.*, **62**, 930 (1940).

Sesame Cake and Antler Growth

ON July 8, 1939, an article by a special correspondent of *The Times* directed attention to the beneficial influence of sesame cake on the growth of antlers. In trials at the London Zoo the antlers of a reindeer, a wapiti and a red deer no less than ten years old considerably improved after they had received the cake. These results confirmed the wider experience of Mr. Franz Vogt, who had previously reported that antler growth among the red deer on his Czechoslovakian estate had increased fifty per cent after adding the cake to their ration[1].

The cause of the stimulation of antler growth is uncertain. The question was brought to our notice by Prof. Julian Huxley. After discussion with him a few experiments were planned to throw light on the problem.

There appeared to be two possible explanations. Either Mr. Vogt was correct in thinking that the sesame cake improved the nutritive balance of the diet of the animals, in particular making good a common deficiency of calcium, or the cake contained an androgenic or gonadotrophic substance effective on oral administration. The latter explanation seemed unlikely, in view of the fact that sesame oil has been widely used as a convenient solvent for administering sex hormones by subcutaneous injection; but it was thought to be worth while making a few experiments which should be decisive.

Accordingly, samples of sesame products were assayed for androgenic and gonadotrophic activity.

The androgenic assays were made with capons. The grain and mash ration was gradually replaced by crushed sesame cake and meal until after ten days they were each receiving 60 gm. of the products daily, supplemented by one feed a week of their normal diet. Measurements made at intervals during the two months period of treatment gave no evidence of comb-growth.

Sesame cake or seed was ground and mixed in equal parts with a normal rat diet, and each mixture fed to groups of immature female rats, for periods of 12 and 42 days. This resulted in an intake of each product of 2–3 gm. per day, and the growth of the animals was quite normal. Ovaries, adrenals, uteri and hypophyses were then dissected out and weighed, but in no case was there any indication of an increase in the weights of these organs. Histological studies of these and the thyroid glands showed no abnormalities.

These negative responses seem to dispose of the possibility of direct or indirect hormonal control of antler growth by any component of sesame products.

We are thrown back, therefore, on the alternative view, for which Vogt has already provided substantial evidence, that it is the high calcium content of the cake, and possibly other nutritive components, which facilitates rapid and increased development of the antlers.

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[1] Vogt, F., "Neue Wege der Hege" (J. Neumann, Neudam, 1936).

Effect of Skin Coatings on Apples

In recent years considerable attention has been given by Hitz and Hant[1], Kaess[2], Smock[3], Platenius[4] and others to the use of skin coatings for the preservation of fruits and vegetables.

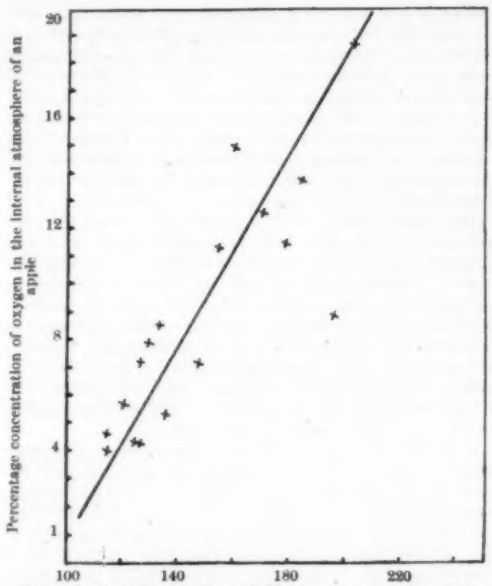
Experiments in this laboratory on Granny Smith apples have been carried out by investigators of the Division of Food Preservation of the Commonwealth Council for Scientific and Industrial Research in co-operation with the Department of Agriculture of New South Wales and the Botany School of the University of Sydney. The fruit was coated by dipping it in solutions of emulsions containing various proportions of oil, wax and shellac prepared so that the total solids were of the order of 5–10 per cent.

The relationship between treatments, internal oxygen and carbon dioxide concentrations, and external respiration has been investigated over a range of temperatures. The method used in analysing the internal gas composition was similar to that of Wardlaw, Leonard and Barnell[5] for papaws and bananas.

Smock and Platenius have shown that there is a marked lowering of oxygen consumption in fruits and vegetables treated with wax emulsions. Numerous workers have shown also that decreasing the external oxygen concentration (within certain limits) decreases the carbon dioxide output of pre-climacteric apples. Our results for pre-climacteric apples indicate that treatment with skin coatings reduces the internal oxygen concentration and thus the external output of carbon dioxide, but does not appear to increase the internal carbon dioxide concentration. The correlation between the internal oxygen concentration and the external output of carbon dioxide is shown in the accompanying figure.

As the storage period is prolonged, it seems that there is a gradual fall in the internal oxygen concentration of untreated fruits due to decreased permeability accompanying ripening changes, and eventually anaerobic respiration may occur. Though treatment with a skin coating may delay the onset of ripening changes, it will accelerate the fall in oxygen concentration when ripening does begin.

Prior to the onset of anaerobic respiration internal disorders may develop in fruit in which the internal oxygen concentration has been reduced to a low value by treatment with a skin coating. In this connexion it is interesting to record that lesions identical with 'brown-heart' developed in Granny Smith apples in which the internal oxygen concentrations were reduced to approximately three per cent by a skin coating but in which the internal carbon dioxide concentration was not significantly increased. Previously 'brown-heart' has generally been associated with fruit stored in atmospheres containing considerably more carbon dioxide than is present in air.



Alcoholic fermentation and internal disorders do not always develop after treatment, and in some cases skin coatings prolong the storage life. The conditions of picking maturity and storage under which a treatment may be beneficial for any particular variety of apple therefore require careful investigation. Other experiments with the Sturmer Pippin, Jonathan, Stayman Winesap, and Rome Beauty varieties indicate that different varieties respond very differently to the same treatments.

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[1] Hitz, C. W., and Hant, I. C., *Proc. Amer. Soc. Hort. Sci.*, **36**, 440 (1938).
[2] Kaess, G., *Z. Ges. Kalteindustr.*, **45**, 227 (1938).
[3] Smock, R. M., *Proc. Amer. Soc. Hort. Sci.*, **33**, 284 (1935).
[4] Platenius, H., Bull. 723, Cornell Agr. Exp. Sta. (1939).
[5] Wardlaw, C. W., Leonard, E. R., and Barnell, H. R., Mem. No. 13, Imperial College of Tropical Agriculture, Trinidad (1939).

Detection of Clay Minerals in Soil Mortars by Photo-electric Cell

A RECENT communication by V. L. Bosazza[1] lends point to a description of the application of the photo-electric cell to the determination of the nature of the clay minerals present in soil mortars. After treatment with a solution of malachite green for a period of 10–15 min. to permit of base exchange, the liquid is filtered into a glass cell. The degree of decolorization of the filtrate is a measure of the amount of base

exchange between clay minerals and stain, and this can be evaluated quantitatively by placing the filtrate between a light source and a photo-electric cell having a sensitive galvanometer in circuit. Clay fractions which are dominantly quartzose in type remove little of the stain, while those of the kaolinite or beidellite types produce an almost clear filtrate. Colour differences in the filtrates obtained from different clay fractions can then be measured by means of the galvanometer.

The importance of the mineral content of soil mortars has already been demonstrated[2], and the method outlined above offers a rapid means of detection of soil mortars rich in either kaolinite or beidellite clays. It is then only necessary to measure the relation between the volume of the soil mortar and its water content in order to distinguish between soil mortars with dominant kaolinite and those in which beidellite clays are the more abundant. In the former case the expansion is far less than in the latter on increase in moisture content.

It is very unusual to find any reference to the exact nature of the clay fraction present in gravels used for highway foundations when reference is made to the large American and other literature on this subject. Unless this fact is taken into account, serious foundation failures are likely to occur owing to the presence of dangerous clays having marked expansive properties, and it is clear from recent work in the Union of South Africa that the physical properties of the minerals forming the clay fraction are of dominant significance in determining the behaviour of such gravels under field conditions.

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[1] BOSAZZA, V. L., NATURE, **146**, 334 (1940).
[2] Knight, B. H., *J. S. African Soc. Civ. Eng.* (July 1940).

Reservation of Scientific Workers

THE classification of scientific workers in the Schedule of Reserved Occupations results in an extremely inefficient use of scientific talent for the national cause, and is giving rise to much bewilderment and exasperation.

The list includes a few highly special classes, and a few very broad ones, with a variety of ages of reservation. The difficulty is that many classes overlap, and that most scientific workers can with equal propriety be included in several of them. An early example arose from the separate classification of university teachers and research workers in universities. Most science lecturers do some research, and many of them devote nearly all or even all their time to research. Chemists, physicists, histologists (not human), exist side by side with the class which can cover them all, namely, that of "research worker in a recognised institution". In practice, this last class includes those whose specialities are not separately listed, and those who fall midway between other listed categories. A physical chemist, being neither quite a chemist nor quite a physicist, would register in the general class, with the result that he is now reserved at thirty, instead of at twenty-one, as he would have been had he called himself a physicist.

The situation, which is certainly most worthy of contemplation, is that of a scientific worker being called up while his own laboratory assistant is left. This has already happened, and must soon be happening on a large scale, for the laboratory assistant is reserved at twenty-five in his trade capacity and at twenty-one for general service, which has meant, in practice, that he is reserved at the lower age. Yet it usually takes the man of science as many weeks to train his assistant as he himself took years to be trained.

A most remarkable complete omission from the list is that of mathematician; if he applies his mathematics to physics he may be reserved as a physicist, but if his mathematics are sufficiently 'pure' to be applicable to all sciences, then he is not reserved at all. A biologist, who has specialized in genetics, may be of the greatest use to agricultural research, but he will be called up under thirty, because there are too few geneticists to make a separate category.

These anomalies have given rise to the curious practice of changing the description of the occupation on the Ministry of Labour Index, as ages of reservation alter. A more rational procedure, and one which would give less work to the departments concerned, would be to make individual reservations on the basis of information filed at the Central Register. Since this information was recorded before the issue of the Schedule it would be unbiased by any consideration of reservation ages and, moreover, includes proper particulars of capacities to do work outside the present occupation.

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Early Post-Glacial Conditions in England

DR. L. HAWKES'S[1] interesting letter raises wide issues, if (as we believe should be done) the more precise term 'early Post-Glacial' be substituted for 'Pleistocene'. That a tundra condition in Britain succeeded the disappearance of the Pleistocene ice-sheets now seems more than probable. Evidence for this is widespread. In the great sand-pit at Greenside, north Durham, one of us (W.A.) in 1936 noticed several 'sand-dykes' with funnel-shaped tops, which we agreed were due to frost cracking. Since then many other instances have been noted in north-east England, always in surface deposits, and usually, though not invariably, in gravels; and solufluxion phenomena are known on the Yorkshire coast, while other tundra phenomena abound in the north Lincolnshire gravels.

These data confirm Kilroe's[2] admirable description and figure (made so long ago as 1908) of frost-cracks in some north Irish gravels, and recorded by him as proof of tundra conditions. Each and all are definitely Post-Glacial. They are therefore presumably contemporaneous with Nehring's tundra period of the north German Plain. May it not be that Reid's[3] "thoroughly Arctic fauna and flora", so well known in the south of England, as seen in the Coombe Rock and other deposits, are of similar date?

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[1] NATURE, **146** 560 (1940).
[2] *Mem. Geol. Sur. Ire.*, "Geology of Country around Londonderry", **62**, 63 (1908).
[3] *Quart. J. Geol. Soc.*, **43**, 369 (1887).

RESEARCH ITEMS

Bronze Age Cemetery near Glasgow

IN May 1936, the discovery by a workman of "a strange old pot" at Springhill Farm, Baillieston, near Glasgow, led to the identification of a cemetery site on which excavations were carried out by J. Harrison Maxwell, so far as agricultural operations allowed, in the months following until the next sowing for crops (*Trans. Glasgow Archæol. Soc.*, N.S. **9**, 4; 1940). The cemetery contained three cremation burials. The first burial found was indicated by two food vessels, of which one, rather squat, was remarkably beautiful. Here no human remains were definitely detected, but carbonized wood nearby may indicate either a wooden vessel or a cremation burial. The second burial was a cist with two lots of cremated bones. Although no grave goods or pottery were found, it had all the characteristics of a bronze age burial. Two small heaps of ashes were found on top of the north cover stone; nineteen white quartz pebbles were associated with the bones. A remarkable feature of the north cover stone was a cut-out, somewhat oblong in shape, measuring 6¼ inches by 3½ inches and about half an inch in depth. A shallow groove runs through the middle of the cut-out and across the stone. The cist was of unusual form, being tongue-shaped, measuring 4 ft. in length and 21 in. in greatest breadth at the south end. A blue glass bead was found at a depth of 2 ft. about 20 ft. from the Food Vessel site. Six inhumed burials were found, but in the absence of pottery, etc., cannot be dated. Two square pits containing charcoal and iron slag prove the existence of a bloomery here in the Early Iron Age or later.

Anuran Parasites

SEVENTEEN years ago, Maynard M. Metcalf gave an account of the opalinid ciliate infusorians which, with few exceptions, are found in the anuran amphibians, in which they are widely and generally distributed. The author himself has continued the work in the interval and other workers have also added both to the number of known species, the life-histories and the cytology of the family. This work is now reviewed in considerable detail by the same author (*Proc. U.S. Nat. Mus.*, **87**; 1940). The two publications constitute a monograph of the Opalinidæ. In the present paper thirty new species are described and illustrated, as are also the species recorded by other workers in the interval. Perhaps the most interesting section for the general reader is that dealing with the geographical distribution of the parasites and their hosts. It is illustrated by numerous maps, and gives the author an opportunity of speculating on the phylogeny of both the Anura and the Opalinids.

Corpus Luteum in Reptiles

SINCE the endocrine functions of the corpus luteum are so intimately bound up with phenomena essentially associated with mammalian reproduction, it is interesting to find that a similar organ is developed in reptiles. A good account of it in a gecko, *Hoplodactylus maculatus*, has been given by Mary M. Boyd (*Quart. J. Micro. Sci.*, **82**; 1940), who also provides a description of the ovary and various stages of oogenesis. As in other craniates laying megalecithal eggs, a prolonged diplotene stage is passed through. The egg is provided with a striated membrane composed of material similar to that of the zona pellucida. The epithelial wall of the follicle, originally many-layered and exhibiting three different types of cells, is reduced to a single layer. The corpus luteum itself is very similar to that in the marsupials and is composed of luteal cells and fibroblast cells from the theca externa, but the cells of the theca interna do not take part in its formation. While a lipoid secretion is present in the luteal cells, there is as yet no experimental evidence as to its functional significance.

Placentation of Hyrax

A FULL account of the placentation of *Procavia capensis* is given by G. B. Wislocki and O. P. van der Westhuysen (Cont. to Embryology, Publ. Carnegie Instit., **171**; 1940). It is found that a transient yolk-sac and a permanent allantoic vesicle are represented, the latter developing into a large four-chambered sac. The trophoblast proliferates over the entire surface of the blastocyst. A trophoblastic network is formed into which chorionic mesoderm gradually penetrates. The placenta is of the hemochorial type. The memoir is well illustrated, and the authors' conclusions may be quoted. "The placenta and fetal membranes of Procavia, the elephant and the manatee exhibit very close structural affinities. Furthermore, the peculiar configuration of the allantoic sac and its vessels is practically identical in Procavia and in lemurs; otherwise placentation in these two groups is quite dissimilar. The mode of development of the placental labyrinth in Procavia resembles very closely that occurring in Tarsius. The marked similarities between the placentæ of Procavia, Elephas and Trichechus are interpreted as indicating phylogenic affinities, whereas the similarities between Procavia and the lemurs and the tarsoids are regarded as representing independent, parallel lines of development."

Central American Plants

DURING 1938–40 two botanical expeditions to Guatemala were led by P. C. Standley and J. A. Steyermark of the Field Museum, Chicago. All but one of the twenty-two provinces of the country were visited and very extensive collections were made. A preliminary report has been published (Field Mus. Nat. Hist., Bot. Series, **22**, No. 4; Sept. 1940) containing descriptions of some of the many new species discovered together with notes on plants new to the country and otherwise notable species. Forty-six new species and four new genera are described. An outstanding discovery was a plant which the authors have named *Rojasianthe superba*. This they describe as "one of the most elegant and beautiful plants we have ever seen" and "one of the handsomest and showiest of the Compositæ ever collected". It has large heads with paper white or lilac tinged ray florets and black disk florets; in habit and appearance it suggests an affinity with Dahlia, but it possesses highly distinctive generic characters. It was dis-

covered in ravines in the mountains of western Guatemala ranging from 7,000ft. to 12,000 ft., and the authors believe that it might flourish in southern England. It is remarkable that a plant of such exceptional beauty and horticultural merit should have escaped detection for so long. Another new genus is Orthion (Violaceæ) from northern Guatemala and British Honduras. Two arborescent species are described, one a tall tree attaining 18 metres with a trunk 45 cm. thick.

The Composition of Human Hair

IT is known that eukeratins, for example, wool and hair, are distinguished from pseudokeratins in that their basic amino-acids (histidine, lysine and arginine) are found in a relatively constant molecular ratio of 1 : 4 : 12. The proportions of non-basic amino-acids show wide variations, particularly with respect to cystine, a high content of which is characteristic of keratins. Previous workers have reported no constant relation between cystine content and colour, age or sex, although there was an apparent tendency for the values to be larger in adult hair. R. C. Clay, K. Cook and J. I. Routh (*J. Amer. Chem. Soc.*, **62**, 2709; 1940) have made experiments on the cystine, cysteine, nitrogen and sulphur content of 120 samples of human hair. No consistent relation between age and composition was found. There was more cystine and cysteine in male than in female hair. Dark hair contained more cystine than light hair. No significant variations in the nitrogen and sulphur content were observed.

Oxygen Exchange between Water and Anions

THE use of heavy oxygen ^{18}O as a means of investigating the mechanism of certain reactions has been recognized and many investigations in this field have been made, and some general conclusions have been drawn. The rate of reaction is often determined by the *p*H of the solution. The exchange of oxygen between water and the chromate, hydrogen sulphate, sulphite, metabisulphite, thiosulphate and permanganate ions, under conditions of varying temperature and *p*H, has been investigated by G. A. Mills (*J. Amer. Chem. Soc.*, **62**, 2833; 1940). Exchange with sulphates in acid solution agrees with the reversible formation of anhydride $H_2SO_4 = H_2O + SO_3$. The exchange with chromates proceeds faster than can be accounted for by the reaction $Cr_2O_7'' + H_2O = 2\,HCrO_4'$ and the reaction $CrO_3 + H_2O = H_2CrO_4 = H^+ + HCrO_4'$ is suggested. No exchange was observed with potassium sulphite. No evidence of direct interchange of oxygen atoms was found. For some anions addition and subsequent removal of H_2O or OH' to the anion is apparently the mechanism, whilst with the bicarbonate ion previous work has shown that the mechanism is hydrolysis to form undissociated acid followed by reversible anhydride formation. The last mechanism is shown to account for the exchange reactions with inorganic oxy-anions.

Heat of Hydration of the Proton

THE heat of hydration of the proton: H^+ (gas) + Aq. = H^+_{aq} may, as is known, be calculated by the Born-Haber cycle applied to a halogen hydracid Hx. The calculation involves a knowledge of various magnitudes, some of which have recently undergone revision, and also some assumptions. E. C. Baughan (*J. Chem. Soc.*, 1403; 1940) has recalculated the value for all four halogen hydracids, arriving at the average value of 282·5 k.cal. (± 3 k.cal.). The heat of hydration of the proton is required in the application of cycles of the Born-Haber type to acids and bases, and this new value appears to be preferable to the one previously calculated from the data for HCl only. It should be remembered, however, that several assumptions have been made in the calculation.

The Surface of Mars

THE close approach of Mars to the earth a year ago provided a favourable opportunity for close observation of the planet's disk from southern latitudes. Dr. E. C. Slipher of the Lowell Observatory, who obtained some 8,000 photographs from South Africa during the summer of 1939, describes his work in the *Telescope* of September–October 1940. The article is illustrated with nearly forty half-tone reproductions of selected plates; from these excellent copies some idea can be obtained of the fine detail reached by the original photographs. The irregular changes noted during the opposition were striking and are described in some detail; the seasonal changes followed their expected course and are dealt with briefly. Dr. Slipher claims that his photographs record so many of the 'canals' and 'oases' in the positions and of the forms shown on Lowell's maps of the planet that the reality of these markings must now be regarded as beyond doubt. A recent suggestion that the canals are divisions between areas of unequal shading is discounted; no example has been discovered where the surface brightness on the two sides of a canal shows any visible difference. The colour-filter photographs suggest that the hazy north polar hood, which showed very rapid day-to-day variations of form during the 1939 opposition, is atmospheric in origin; it precedes and accompanies the deposition of the more brilliant white polar cap, and may consist of very fine ice spicules.

Variable Extent of the Atmosphere of Zeta Aurigæ

A. BEER (*Mon. Not. Roy. Astro. Soc.*, **100**, 8–9; June 1940) has discussed material relating to the 1937 eclipse of this star, though the observations were made difficult by the low altitude of the star and by cloudy periods. The chief point in the paper is concerned with the remarkable behaviour of the *K* line of Ca II, and as this is produced in the extensive atmosphere of the *K*5 giant, significant changes in the structure of the atmosphere of this star are indicated. The new spectroscopic material covers about a month before the beginning of the 1937 eclipse (April 21·85) and the spectrophotometric investigation of the material was performed with the recording photomicrometer of the Solar Physics Observatory, Cambridge. Christie and Wilson (*Astrophys. J.*, **81**; 1935) derived a theoretical expression for *N*, the number of atoms in the line of sight, based on Milne's theory of chromospheric equilibrium, and the failure of the 1934 observations to support the theory led them to remark: "Accordingly we conclude that the observations of the Ca ii envelope surrounding ζ Aurigæ are in disagreement with the predictions of Milne's theory." Fundamental changes in the atmosphere of the star during the 1937 eclipse do not allow this conclusion to be maintained, and, as Beer points out, there is now a much improved agreement with Milne's theory.

OIL SEARCH AND OCCURRENCE IN GIPPSLAND, VICTORIA

SIR EDMUND TEALE, in a desire to clarify the position with regard to the occurrence of oil in Gippsland, has carried out a critical examination of published literature on the subject and has also paid a personal visit to the Lakes Entrance region in company with a geologist, a palæontologist and a consulting engineer. The report of his findings issued in July of this year shows that, in so far as the literature is concerned, this is in many ways incomplete and, moreover, embodies a wealth of conflicting opinions. For example, the Oil Advisory Committee's report of February 1937 reflects a cautious but optimistic view of oil possibilities in the Lakes Entrance area, while another report issued by the same authority and only a year later takes a definitely pessimistic outlook of such possibilities. A third report issued by the Committee at the end of 1938 was as constructive as the preceding one had been destructive.

Mr. E. A. Kodyen's report, written in 1939, considered the possibility of repressuring the Lakes Entrance field, but met with little support and definite opposition from Dr. A. Wade. Mr. F. Chapman advanced the view that there is a considerable thickness of "granite wash" below the glauconite or oil horizon, but this was not accepted by the Mines Department, which contends that the glauconite rests on or near bedrock. In spite of the importance of this point, reluctance was shown to permit the Government drilling plant to be used to decide the question. In 1937 Dr. Arthur Tieje visited the field and afterwards urged that a more complete and detailed study of underground structure should be made; but the investigation is still far from complete.

Sir Edmund Teale in his report maintains that incontrovertible data are still insufficient to permit accurate estimates to be made of proved resources. Moreover, investigations are not far enough advanced for any recommendations to be made as to the best method for recovery of the oil and the percentage which should be recovered. Nevertheless, results of carefully recorded tests carried out by the Austral Oil Company indicate that the area, if exploited, might be comparable with other low-pressure production fields in different parts of the world. Admittedly the oil is not petroliferous, but it yields three useful products, all of which have at present to be imported. These are bitumen, heavy oil and lubricating oil. In view of the usefulness of these products *per se*, it would not be necessary to consider the installation of cracking plants for the production of petrol. A disadvantage of the field is that it is definitely a low-pressure area where ordinary pumping methods are of little use. Some form of pressuring would be necessary and before embarking on any such scheme, expert advice would have to be procured.

During his inspection of the field, Sir Edmund visited Holland's Landing, near the western shore of Lake Victoria, where there is a modern plant in operation capable of attempting to penetrate the Tertiary deposits, which there attain a thickness of some 3,600 ft. In addition, sites were visited where scout drilling was in operation and also where boreholes had been completed and cores preserved for inspection. For the most part, however, there was evidence of much haphazard and unprofitable drilling carried out by private enterprise. Reliable records had not been kept until recently, when the Austral Oil Company undertook to make a series of regular tests from selected boreholes over a considerable period of time.

Sir Edmund's general impressions of his visit are summarized at the end of his report. Evidence of proved and potential oil in the Lakes Entrance area, in his opinion, warrants installation of approved methods to attempt recovery on a commercial scale. To this end the best technical advice procurable should be obtained. More geological information is required regarding the glauconite zone, the nature and thickness of underlying formations and the floor upon which they rest. Tertiary formations outside the Lakes Entrance area require special and more adequate exploration than is at present the case. Geophysical methods would facilitate this work.

Finally, in view of the present demand for oil of all kinds, Sir Edmund maintains that the undertaking should enlist the support of the Government and of private enterprise. Moreover, there is an urgency in the matter which calls for the immediate speeding-up of activities in this direction.

ORIGIN OF THE EGYPTIAN CALENDAR

THE calendar of the ancient Egyptians was one of the earliest experiments in calendar making, and it was one of the most enduring. It was still in use at the beginning of the Christian era much as it had been in the Pyramid age three thousand years before, having had an uninterrupted existence throughout more than half of man's recorded existence. Many theories, all differing fundamentally, have been put forward as to its origin. These have been reviewed recently by H. E. Winlock ("The Origin of the Ancient Egyptian Calendar", *Proc. American Philosophical Soc.*, **83**, No. 3; 1940), introducing a further suggestion as to the natural phenomena which first marked the changing seasons for the ancient Egyptians and came to be the foundation of their calendrical system.

The approach to the problem has usually started with a statement by Censorinus in A.D. 238 that the Egyptian New Year Day in A.D. 139 fell on July 21 when the bright star Sothis (Sirius), after having been invisible for a season, made its annual reappearance in the eastern sky just before sunrise. Since the

Egyptian civil year was one of 365 days and the Sothic year was one of 365¼ days, this coincidence could have happened only at intervals of about 4 × 365 years or in 1317, 2773 and 4231 B.C. At the two earlier of these dates (assuming that 2773 B.C. fell in the Fourth Dynasty) the calendar was already in use; and hence Edward Meyer, in 1904, concluded that the calendar must have been introduced in 4231 B.C., since its introduction was possible only on the occasion of a coincidence of the opening of the Sothic and the calendar years. This dating, however, relegated the origin of the calendar to distant prehistoric days, long before King Menes, the first historical king who united the two lands of Egypt, and dated by Meyer himself at 3200 B.C.; consequently it involved the uninterrupted use of the calendar for a thousand years before the use of writing began.

The difficulties in the way of accepting such a conclusion led to numerous modifications of Meyer's theory by Breasted and others; but in recent years the tendency has been toward the more reasonable hypothesis that the calendar was the product of some later period. One of the most ingenious schemes for avoiding the difficulty is that of Prof. Jotham Johnson, who argues that the Egyptians had a lunar calendar until June 18, 3251 B.C., when the heliacal rising of Sothis coincided with a new moon. From that day the calendar was fixed to Sothis, but gradually became so far divorced from the terrestrial seasons that by June 18, 2773 B.C., a whole four-month season's correction was necessary and it was abandoned for the wandering year of the historic period. Another suggestion is that of Alexander Scharff, put forward in 1927, which attributes the invention of the calendar to 2773 B.C., but assumes that before then time was reckoned by an entirely different system, based, it would appear, on a year of 320 days. O. Neugebauer, however, had suggested that observation of the Nile flood over prolonged periods would give by averaging a year of 365 days without the observation of any heavenly body whatsoever, and this, Scharff holds, supplies evidence of the nature of the calendar in use before 2773 B.C. and possibly so late as 2000 B.C.

In this connexion it is pointed out that, certain modern studies on the Egyptian calendar notwithstanding, the whole history of a year with intercalations is a history of an innovation obnoxiously foreign to the native Egyptian; and there is no hint in the whole four centuries and a half covered by the classical literature that the Egyptians had any memory of ever having used a fixed year or of ever having recognized its desirability.

The calendar of the historic period gives clear evidence that it originated in the climate of the land. In this rainless climate all living things in the Nile valley have been dependent on the Nile flood. The river is at its lowest at the First Cataract about the end of May and at the head of the Delta some two weeks or more later. Soon after the level begins to rise, reaching its height at the First Cataract about September 1 and a month later at the Delta head, where by the middle or end of October the highest flood lands begin to emerge and the waters fall until they reach their lowest again in the following June.

From the palæolithic period onwards the occupations of the inhabitants, whether hunting, fowling and fishing, and pasturage when they acquired domesticated animals, or cultivating the seeds they had learned to save from the last low Nile—all these occupations were profoundly affected by the fluctuations of the Nile. In the season known later as *Akhet*, 'the flood', they were forced to abandon their settlements on the banks and in the marshes; as the waters fell, *Proyet*, 'the coming forth', the spring, they followed the retreating flood along the alluvial plain; and in *Shōmu*, 'the low water', or in its later meaning 'the harvest time', they returned to the river and the permanent swamps and waited for the next flood. Thus the ancient Egyptian recognized but three seasons, and when he adopted a word for year he chose a form of *ronpy*, 'to be young' or 'fresh', as of plants, considering the year as beginning at the first signs of the rising water which would bring out the verdure once more.

By the time stone age man felt the need of some other means of predicting the future stages of the river, probably in connexion with the operations of agriculture, he must already have become accustomed to counting the phases of the moon—with the rising Nile four moons to the time of sowing, then four moons for the grain to ripen, and a third four moons before the flood would appear again. Notwithstanding the error in a lunar year of 354 days, and irregularities in the flood itself, the moon would serve as a practical rule of thumb. Traces of the lunar reckoning survived under a more practical calendar in the subdivision of the year into twelve parts, each called by the name of the moon, *abou*, as in our months. About 1850 B.C. lunar months of alternatively 28 and 30 days served for priestly temple service. Traces appear in religious calendars down to Roman times and the king was crowned on the day of the full moon. In 1100 B.C. astronomical tables still had a technical term for the mid-month derived from the time when a month was a moon and the mid-month was full moon time.

Lunar reckoning, however, was always of secondary importance for the Egyptians; and while other lunar calendars count each day from sunset, the Egyptians alone of all ancient peoples commenced their day at dawn and the same ideogram stood in their system of writing for "sun" and "day". Nevertheless the Egyptians never adopted solar seasons. Their seasons were always those of the Nile. Only for a brief period in the fourteenth century B.C. did Egyptian beliefs give full credit to the sun for its controlling influence on terrestrial life. It was only in classical times that the solstice was an omen of the coming inundation (*cf.* Herodotus and Pliny).

The rise of the Nile and lunar reckoning proving unsatisfactory as a means of time-reckoning for a people becoming more and more cultivated, and, the sun seeming to have no connexion with the question, the Egyptian, like other primitive peoples, turned to the sky for a sign that his new year was approaching. For this purpose he chose the heliacal rising of Sothis, which about 7000 B.C. was visible at the head of the Nile delta round about May 21 and in 3500 B.C. on June 17, and by 2800 B.C. on June 23. The later it came the more certain it was to be regarded as a harbinger of the flood. So early as the dawn of the historic period, that is, at the time of Menes, the Egyptian was already regarding Sothis as the harbinger of the all-important inundation. This is shown by a primitive inscription on an ivory tablet from a royal tomb at Abydos in which Sothis is called "Bringer of the New Year and of the Inundation" and in a Pyramid text as the creator of all green growing things and hence of the year itself. Thus the association was at least as early as 3200 B.C. The official observation of the reappearance of Sothis, it is to be noted, took place at Memphis, which was founded by Menes.

It is suggested, therefore, that the Egyptian of the time of Menes was starting his year with an observation of the reappearance of Sothis. The threefold division of the year was borrowed from prehistoric customs with some modifications. The three seasons, flood, spring and harvest, each consisted of 120 days. The 'moons' were continued as 'months' for official purpose of 30 days exactly, or three ten-day 'weeks', and the year consisting of twelve months with five days "over and above the year", subject to variation of one day or more owing to inaccurate observation and the occurrence of an extra day each fourth year. This endured during the first two dynasties, yet it is known that throughout the later historical period the year differed from the star and the Nile. When was this "wandering" year first used? Between 1317 B.C., when the New Year coincided with the appearance of the star, and 2773 B.C., there are several items of evidence that the civil calendar was consistently 'wandering' and at variance with the true seasons by about one day for each four years which had elapsed since 2773 B.C. The conclusion is inescapable that in that year the calendar had been in agreement with that star, and that in that year the observations on which that relation had depended were discontinued. The date is astronomically fixed as the start of the wandering calendar of succeeding centuries.

It is suggested that the change may have taken place in connexion with the period of prosperity which followed on the accession of Djoser, founder of the Third Dynasty, in 2778 B.C. The host of census takers, tax collectors and royal scribes who were engaged in managing the land under a powerful centralized government no doubt found a year whose beginning depended upon the observation of a star highly inconvenient, and preferred to adopt a year with a definite period of 365 days. Owing to the discrepancy between this year and the heliacal rising of Sothis amounting to one day in each successive period of four years, by a century or so later it became necessary to observe two New Year days, "the Opener of the Year" or "the Coming Forth of Osiris" and "The First of the Year", the latter in all likelihood being the New Year inserted into the calendar when it became definitely and obviously separated from Nature. When the calendar became less and less dependable in foretelling the true season, it was probably the time at which the priests invented the coronation oath which called for the new king to swear "never to intercalate a month or a day, nor to vary a festival, but to preserve the 365 days as they were ordained of old".

On the view here put forward the ancient Egyptian calendar was not an invention on any one day at dawn, when a series of phenomena happened to coincide, but it was a gradually developed method of predicting approximately the almost unpredictable rise of the Nile. For a few centuries before 2773 B.C. it depended upon observation of the reappearance of Sothis, and the resulting self-adjusting year was as true a measure of solar time as was the later Julian year. As man became more cultivated he felt the need of some measure of time-reckoning more definite than Nature itself. In 2773 B.C. he dropped the New Year observations and took up the 365-day year, which actually brought his seasons back into their original places only once again during his whole history.

THE FUEL RESEARCH BOARD

THE report of the Fuel Research Board for the year ending March 31, 1939, has recently appeared*. As this date was passed more than one and a half years ago the contents have lost their freshness. They reveal the measure of activity of national research on fuel problems before the outbreak of war and allow the reader to judge of the use made of the results.

The report opens with the work of the coal survey—one of the most important branches of the Board's activity. To realize this it is only necessary to recall the limited and superficial character of the scientific data about British coals during the War of 1914–18. The information accumulated in the meantime has already been turned to good use. It is also noticeable that the survey officers have passed the mere compilation of analytical data and have been able to reach valuable conclusions about the properties and applications of coal and the geology of the coalfields.

The growing importance of coal preparation is shown by the length of the relevant section, which reaches forty pages. Coal users are no longer content with any fuel, and even the householder is unwilling to receive and break under his own roof large lumps of fuel. Modern housing is not designed to store large stocks of dirty material which necessitates manual preparation before use. Effort is being made to prevent dust by coating lump coal with oils and hygroscopic salt solutions—problems which give rise to interesting physical problems. Although the distribution of fuel in fluid form has obvious advantages, war-time conditions show that there is merit in the possession of household stocks of solid fuel which a dispersed population can enjoy.

Oil synthesis from coal by different routes occupies the largest share of the report. Coal and coal tars—particularly the latter—form a source of liquid fuel. Hydrogenation of tars and oils was applied first to low-temperature tars and continued with gasworks tars, then coke-oven tars. As the work has proceeded the discovery of more active catalysts has enlarged the scope of the process.

The production of lubricants from coal has proved more difficult than the production of fuels, at any rate by hydrogenation. More promise is shown by synthesis from mixtures of carbon monoxide and hydrogen—the so-called Fischer-Tropsch process. By polymerization, certain fractions have been converted to products similar to natural lubricating oils suitable for internal combustion engines. Although these were not equal to the Air Ministry's standard, the hope is expressed that this will be reached.

* Department of Scientific and Industrial Research. Report of the Fuel Research Board for the Year ended 31st March 1939, with Report of the Director of Fuel Research. Pp. iv+206. (London: H.M. Stationery Office, 1940.) 3*s.* 6*d.* net.

The use of gas producers for propelling road-vehicles has been studied at the Fuel Research Station since 1923 and in recent years more intensely. The work reported has been concerned mainly with the choice of suitable fuels and done largely in close association with the officers of the Coal Survey. The number of vehicles propelled by producer gas and seen on the roads is relatively small—possibly because the need for petrol substitutes has not been too pressing. There has, however, been no lack of scientific and industrial effort.

The section on domestic heating is largely concerned with the measurement of smoke emission and the means for its abatement. It was found that design of fire-places conducive to securing admixtures of products of combustion with air and to conserving their high temperature would make a considerable reduction in smoke. Unfortunately, present circumstances do not make the advantages of smoke reduction so evident as they will be when peace returns.

H. J. HODSMAN.

FORTHCOMING EVENTS

Wednesday, January 8

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1.) at 2.30 p.m. Prof. S. Zuckerman: "The Problem of Blast Injuries."

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

PRINCIPAL OF LISBURN TECHNICAL SCHOOL AND ORGANIZER OF TECHNICAL EDUCATION—The Secretary, Lisburn and Belfast (Rural) Regional Education Committee, Castle Chambers, Lisburn, Co. Antrim (January 15).

LECTURER IN MECHANICAL ENGINEERING—The Principal, Walsall Technical College, Bradford Place, Walsall (January 18).

ASSISTANT EXECUTIVE ENGINEERS in the Punjab Service of Engineers, Class I—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (quoting Appointment 1/11/A) (January 24).

PROFESSOR OF ANATOMY—The Secretary and Registrar, University, Bristol (January 30).

TEACHER OF ELECTRICAL ENGINEERING in the Smethwick Municipal College—The Chief Education Officer, 215 High Street, Smethwick.

SENIOR LECTURER IN MECHANICAL ENGINEERING—The Clerk to the Governors, South-West Essex Technical College and School of Art, Forest Road, Walthamstow, London, E.17.

REPORTS AND OTHER PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Amgueddfa Genedlaethol Cymru: National Museum of Wales. Mammals and Man: Handbook to a Temporary Exhibition, November 1940 to April 1941. By Colin Matheson. Pp. 22. (Cardiff: National Museum of Wales and Press Board of the University of Wales.) 3*d*. [212

Proceedings of the Royal Society of Edinburgh, Session 1939–1940. Vol. 60, Part 3, No. 26: Some Confluent Hypergeometric Functions of Two Variables. By A. Erdélyi. Pp. 344–361. 1*s*. 6*d*. Vol. 60, Part 4, No. 27: The Design and Interpretation of Experiments based on a Four-fold Table; the Statistical Assessment of the Effect of Treatment. By Dr. W. O. Kermack and Dr. A. G. M'Kendrick. Pp. 362–375. 1*s*. 3*d*. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) [212

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 12, No. 1, June 1940. Compiled by Agnes Elisabeth Glennie, assisted by Gwen Davies and Catherine Robson. Pp. iv+74. (London: H.M. Stationery Office.) 4*s*. 6*d*. net. [512

Hannah Dairy Research Institute. Annual Report for the Year ending 31st March 1940. Pp. 20+4 plates. (Kirkhill: Hannah Dairy Research Institute.) [612

Town Planning Institute. Town and Country Planning: Compensation and Betterment. Report of Committee of the Institute approved by the Council of the Institute, 31st May 1940. Pp. 60. (London: Town Planning Institute.) [612

Memoirs of the Cotton Research Station, Trinidad. Series B: Physiology. No. 13: The Effect of Ringing on the Upward Movement of Solutes from the Root; The Effect of Ringing and of Transpiration on Mineral Uptake. By E. Phillis and T. G. Mason. Pp. 16. (London: Empire Cotton Growing Corporation.) 2*s*. 6*d*. [1012

University of London: Institute of Archaeology. Geochronological Table No. 2: The Age of Neanderthal Man, with Notes on the Cotte de St. Brelade, Jersey, C.I. By Frederick E. Zeuner. (Occasional Paper 3.) Pp. 20. (London: Institute of Archaeology.) 3*s*. [1012

The Control and Extermination of Wild Rabbits. By A. D. Middleton. Pp. 28. (Oxford: Bureau of Animal Population.) [1212

Herbage Publication Series. Bulletin 30: The Grasslands of the Argentine and Patagonia. By William Davies. Pp. 48+7 plates. (Aberystwyth: Imperial Bureau of Pastures and Forage Crops.) 2*s*. 9*d*. [1212

Amgueddfa Genedlaethol Cymru: National Museum of Wales. Thirty-third Annual Report 1939–40 presented by the Council to the Court of Governors on the 25th October 1940. Pp. 49+2 plates. (Cardiff: National Museum of Wales.) [1312

Other Countries

Southern Rhodesia Geological Survey. Short Report No. 32: Report on the Geology and Mines of the Insiza—Fort Rixon Gold Belt. By R. Tyndale-Biscoe. Pp. 23. (Salisbury: Government Printer.) [212

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 191: Measurement of the Period of Natural Vibration of an Airscrew Blade. By Jûichi Obata and Yahei Yosida. Pp. 97–108. 30 sen. No. 192: Viscosity Characteristics of Lubricating Oils as related to their Chemical Structure. By Bunnosuke Yamaguchi. Pp. 109–136. 50 sen. No. 193: Dynamical Stability of a Column under Periodic Longitudinal Forces. By Ikuo Utida and Katsutada Sezawa. Pp. 137–184. 80 sen. No. 194: On the Subsonic Flow of a Compressible Fluid past an Elliptic Cylinder. By Isao Imai and Takasi Aihara. Pp. 185–212. 45 sen. No. 195: Some Experiments on the Forced Vibration of Varying Period. By Katsutada Sezawa and Wataru Watanabe. Pp. 213–228. 30 sen. (Tôkyô: Kôgyô Tosho Kabushiki Kaisha.) [212

New Zealand: Marine Department. Fisheries Bulletin No. 8: Natural Reproduction of Trout in New Zealand and its Relation to Density of Populations. By Derisley F. Hobbs. Pp. 93. (Wellington: Government Printer.) 3*s*. [312

Bulletin of the American Museum of Natural History. Vol. 77, Art. 5: *Meryochoerinae*, a New Subfamily of Oreodonts. By C. Bertrand Schultz and Charles H. Falkenbach. Pp. 213–306. (New York: American Museum of Natural History.) [312

U.S. Office of Education: Federal Security Agency. Bulletin, 1940, No. 2: Statistics of Public High Schools, 1937–38. (Biennial Survey of Education in the United States, Chapter 5.) Statistical Tables prepared under direction of David T. Blose; Text prepared by Carl A. Jessen. Pp. vi+192. (Washington, D.C.: Government Printing Office.) 15 cents. [312

Madras Fisheries Department. Administration Report for the Year 1938–39. By Diwan Bahadur Dr. B. Sundara Raj. Pp. iii+76+2. (Madras: Government Press.) 8 annas. [312

Proceedings of the United States National Museum. No. 3077: Further Studies on the Opalinid Ciliate Infusorians and their Hosts. By Maynard M. Metcalf. Pp. 465–634. (Washington, D.C.: Government Printing Office.) [412

Anthropological Records. Vol. 2, No. 5: The Social Organization of the Haisla of British Columbia. By Ronald L. Olson. Pp. 165–200. 35 cents; 2*s*. net. Vol. 4, No. 1: Culture Element Distributions, 12: Apache-Pueblo. By E. W. Gifford. Pp. vi+208. 2 dollars; 12*s*. net. (Berkeley, Calif.: University of California Press; London: Cambridge University Press.) [612

New Zealand: Department of Lands and Survey. Annual Report on Public Domains and National Parks of New Zealand. Pp. 10. 6*d*. Report on Scenery Preservation for the Year ended 31st March 1940. Pp. 8. 6*d*. (Wellington: Government Printer.) [612

The Dissection of the Shark *Eulamia menisorrah* (Müller and Henle): an Illustrated Guide for the use of First-Year University Students. By G. A. C. Herklots. Pp. 28. (Hong Kong: The University.) 1 dollar; 2*s*. [1012

U.S. Office of Education: Federal Security Agency. Bulletin, 1940, No. 1: Educational Directory, 1940. Pp. iv+48+28+86+72. Know Your School Leaflet No. 55: Know Your State Educational Program. By W. S. Deffenbaugh. Pp. iv+26. 5 cents. (Washington, D.C.: Government Printing Office.) 1012

Commonwealth of Australia. Report of the Director of the Commonwealth Solar Observatory to the Advisory Board. Pp. 8. (Canberra: Commonwealth Government Printer.) [1012

Malayan Forest Records. No. 13: Timber Utilization in Malaya. By H. E. Desch and A. V. Thomas. Pp. ix+81+35 plates. (Kuala Lumpur: Forest Department.) 3 dollars; 7*s*. 6*d*. [1212

Canada: Department of Mines and Resources: Mines and Geology Branch: Geological Survey. Paper 40–13: Preliminary Map, Wapiabi Creek, Alberta. By B. R. MacKay. 10 cents. Memoir 222: Malartic Area, Quebec. By H. C. Cumming and J. W. Ambrose. (No. 2454.) Pp. v+142+7 plates+4 maps. 50 cents. (Ottawa: King's Printer.) [1312

Ministry of Agriculture: Technical and Scientific Service. Bulletin No. 150: Hot Air Treating Machines used in the Ginneries for the Destruction of Pink Boll Worm in the Cotton Seed. By Mohammad Fouad El Gammal. Pp. 20+40 plates. P.T. 5. Bulletin No. 219: Variety-Tests on some Introduced Sugar Cane Varieties. By Gadallah Aboul Ela. Pp. 14. P.T. 2. (Cairo: Government Press.) [1912